FLORA OF PANAMA

Part VII. Fascicle 2*

THYMELAEACEAE

Shrubs and small trees, usually with soft wood and leathery flexible branches. Leaves alternate, spiral, exstipulate, pinnately veined. Inflorescence terminal or lateral, determinate, simple, or compound with the ultimate divisions umbelliform or capituliform. Flowers perigynous, perfect or (in our genera) unisexual and dioecious, regular or rarely somewhat zygomorphic; perianth dichlaymdeous or (in our genera) monochlamydeous through loss of the corolla, usually tetramerous, tubular to salverform or subrotate, more or less petalaceous, usually lepidote or puberulent without, the limb (calyx) 4- to 5-parted; stamens in 1 or 2 cycles, the outer antesepalous and inserted upon the perianth lobes, the inner antepetalous and inserted within the perianth tube; pistil usually 1-carpellate, superior, usually borne upon a short gynophore and subtended by an inconspicuous disc, containing a single pendulous ovule upon the ventral placenta, the stigma capitate, usually sessile or subsessile. Fruit a dry nutlet or small drupe (our genera); seed exalbuminous or essentially so, the embryo with thick convex cotyledons.

Thymelaeaceae are a rather small family chiefly abundant in South Africa and Australia and very poorly represented in the northern hemisphere, particularly in America. Although the small flowers include only vestigial petals at most, occasionally they are attractive because of petalaceous pigmentation of their hypanthium (perianth tube), aggregation into dense clusters, and sweet scent.

The wood of the branches is soft and the young twigs are remarkably leathery and flexible as a rule, hence the popular name Leatherwood for *Dirca palustris*, the unique representative of the family in the eastern United States. This quality of the stems is due in part to the anomalous development of the phloem which frequently forms an abundant interwoven fabric of soft fibers. In fact, Standley (Fl. Costa Rica 2:759. 1937) reports the vernacular name *mastate* for *Daphnopsis seibertii* in Costa Rica, which suggests the making of bark cloth.

a. Stamens 8, sessile or subsessile; pistillate flowers with staminodes..... 1. DAPHNOPSIS
aa. Stamens 4, widely exserted upon slender filaments winged at the base; pistillate flowers without staminodes..... 2. SCHOENOBIBLUS

* Assisted by a grant from The National Science Foundation.

Issued May 27, 1958.

(93)

1. DAPHNOPSIS Mart. & Zucc.

DAPHNOPSIS Mart. & Zucc. Nov. Gen. & Sp. 1:65. 1824.

Hargasseria Schiede & Deppe, ex C. A. Meyer, in Bull. Acad. St. Petersbourg 1:356. 1843.
Nordmannia Fisch. & C. A. Meyer, loc. cit. 355. 1843.
Coleophora Miers, in Ann. & Mag. Nat. Hist. ser. 2. 8:197. 1851.

Shrubs or small trees. Leaves alternate, simple, exstipulate, membranaceous to coriaceous. Inflorescence terminal or axillary, cymose or paniculate, the ultimate branches usually umbelliform or capituliform. Flowers apetalous, dioecious, tetramerous; perianth salverform to campanulate, more or less petalaceous, usually densely puberulent, the limb deeply 4-lobed. Staminate flowers: stamens 8, sessile or subsessile, the outer cycle antesepalous, inserted at the base of the perianth lobes, barely exserted, the inner cycle antepetalous, inserted within the perianth tube; pistillode present, surrounded at the base by a delicate entire or lobed disc. Pistillate flowers usually smaller than the staminate: staminodes 8, 4, or absent; pistil 1-carpellate, containing a single pendulous anatropous ovule; stigma capitate, sessile or subsessile, usually slightly exserted; disc entire or lobed, hypogynous, usually delicately membranaceous. Fruit a small slightly fleshy drupe.

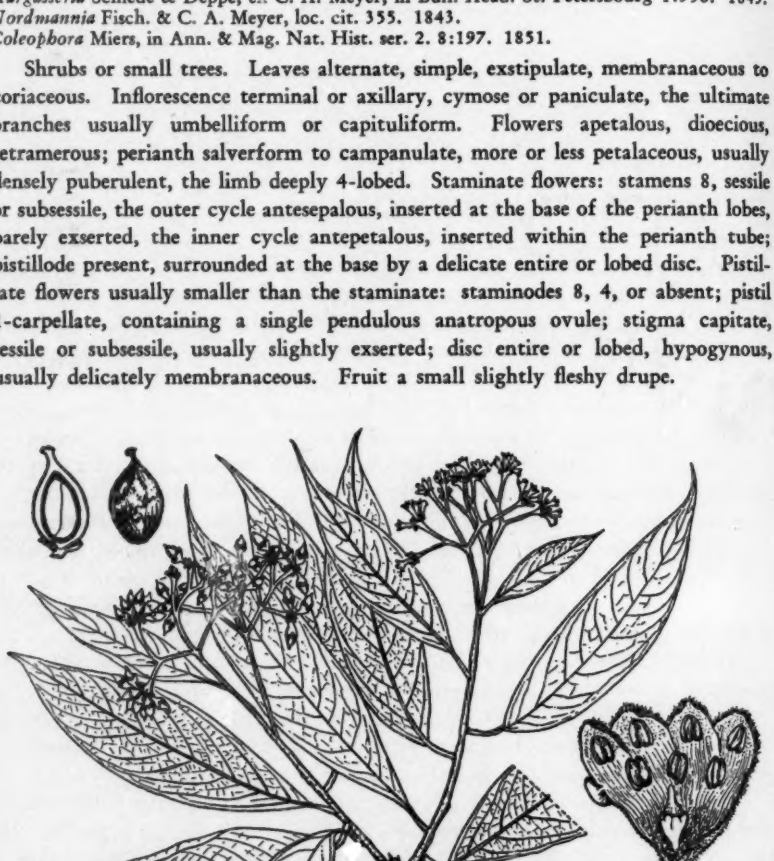

Fig. 29. *Daphnopsis seibertii*

About 25 species in southern Mexico, Central and South America, and the Antilles. A single species in Panama.

1. DAPHNOPSIS SEIBERTII Standl. in Ann. Missouri Bot. Gard. 24:192. 1937

Small dioecious trees 3–10 m. tall. Young stems minutely appressed-puberulent, soon glabrate, the bark pale grayish yellow, with small and crowded verrucose lenticels. Leaves alternate, petiolate, the blade elliptic to somewhat oblong- or oblanceolate-elliptic, acuminate to subcaudate-acuminate, rather narrowly attenuate at the base 6–15 cm. long, 2–5 cm. broad, subcoriaceous, glabrous above, essentially glabrous or minutely and indefinitely puberulent beneath; petiole 1.0–1.5 cm. long. Inflorescence terminal, the peduncle repeatedly dichotomous, densely and minutely appressed-puberulent, ebracteate, about as long as to somewhat shorter than the leaves, the flowers in capituliform clusters of several at the ends of the ultimate branches. Staminate flowers pale cream: perianth campanulate, densely appressed-puberulent without, the tube about 1.5 mm. long, about 2 mm broad at the orifice, glabrous within, the lobes ovate-suborbicular, very slightly unequal, about 2 mm. long, widely spreading at anthesis; anthers about 0.5 mm. long, the outer inserted somewhat below the middle of the perianth lobes, the inner inserted just beneath the orifice of the perianth tube; pistillode about 0.75 mm. long, the stigma almost attaining the insertion of the inner stamens, the disc about half as long as the ovary, cupuliform, crenate; pedicel about 2.5 mm. long. Pistillate flowers pale cream; perianth narrowly urceolate, minutely appressed-puberulent without, the tube about 1.5 mm. long, about 1 mm. broad at the orifice, the lobes ovate-trigonal, strongly unequal, the outer about 1 mm. long, slightly spreading; pistil about 2 mm. long, the ovary ovoid, glabrous, the style short and stout, the stigma capitate, abundantly papillate; staminodia 8, about 0.5 mm. long; pedicel about 2 mm. long. Drupe ovoid, about 6 mm. long, with a very thin pulp, white, essentially sessile.

Nicaragua, Costa Rica and Panama, in highland woodland 60–1000 m. elev.

COCLÉ: between Las Margaritas and El Valle, *Woodson, Allen & Seibert 1281, 1764*; El Valle de Antón and vicinity, *Seibert 416, 444*. HERRERA: Pesé, *Allen 795*.

Daphnopsis seibertii is quite distinct from the other species of northern Central America and Mexico, and is most closely allied to *D. caribaea* Griseb. of Puerto Rico and the Lesser Antilles.

2. SCHOENOBIBLUS Mart. & Zucc.

SCHOENOBIBLUS Mart. & Zucc. Nov. Gen. & Sp. 1:65. 1824.

Shrubs or small trees. Leaves alternate, simple, exstipulate, membranaceous to coriaceous. Inflorescence terminal, paniculiform, the ultimate branches umbelliform. Flowers apetalous, dioecious, tetramerous; perianth rotate, more or less petalaceous, usually densely puberulent, the limb deeply 4-lobed. Staminate flowers: stamens 4, widely exserted upon elongate filaments, antesepalous, inserted at

Fig. 30. *Schoenobiblus panamensis*

the base of the perianth lobes; pistillode minute, stipitate, subtended by a minute, usually eccentric disc. Pistillate flowers (unknown from Panama): somewhat smaller than the staminate; staminodes not reported; pistil 1-carpellate, containing a single pendulous anatropous ovule; stigma capitate and obscurely 2-lobed, elevated upon a short stout style, exserted, subtended by an inconspicuous disc. Fruit a slightly fleshy drupe.

Perhaps half a dozen poorly defined species of northern South America, with one species each in Trinidad and Panama. The few specimens collected almost invariably have been staminate, and structural details of the pistillate flowers are known almost solely from the description of S. *ellipticus* Pilger in which, however, reference to staminodia is not made, intentionally or unintentionally. It is unfortunate that Pilger was not more explicit in this respect.

1. SCHOENOBIBLUS PANAMENSIS Standl. & L. O. Wms., in Ceiba 3:33. 1952.

Small dioecious trees 2–3 m. tall, the branches slender, essentially dichotomous, glabrous or glabrate, grayish brown. Leaves alternate, the blade subsessile, ob-

lanceolate, narrowly subcaudate-acuminate, narrowly cuneate at the base, 12–20 cm. long, 3.5–5.0 cm. broad, rather thinly membranaceous, prominently venose, glabrous. Staminate inflorescences terminal and in the upper leaf axils, paniculiform with few umbellate branches, the secondary peduncles 2.0–2.5 cm. long, minutely appressed-puberulent, bearing about 8–12 small pink and white flowers, the pedicels very slender, about 1.7 cm. long, minutely appressed-puberulent. Flowers densely appressed-puberulent without, rotate, the tube about 1 mm. long and broad at the orifice, pink, the lobes oblong-elliptic, spreading, white, about 4 mm. long and 1 mm. broad; stamens exserted, the filaments about 2 mm. long, the lower half concrescent to the base of the perianth lobes, the anthers about 1 mm. long; pistillode minutely fusiform, somewhat less than 1 mm. long, sparsely pilosulose, the disc flabelliform, eccentric, about half as long as the pistillode. Pistillate inflorescences and flowers, and fruit unknown.

Panama, in lowland forests.

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, *Von Wedel 410*.

The natural affinities of this plant, the specimen of which is rather fragmentary, are quite obscure. It seems to be most closely related to *S. peruviana* of the upper Amazon of Peru which, however, has more copious inflorescences and flowers nearly twice the size of those of *S. panamensis*.

LYTHRACEAE

By LORIN I. NEVLING, Jr.

Herbs, shrubs, or trees. Leaves opposite, whorled or very rarely alternate, simple, entire, pinnately veined, sessile or petiolate; stipules small and caducous or absent. Flowers dichlamydeous, perfect, sometimes dimorphic or trimorphic, in 1- to several-flowered cymes gathered into lateral or terminal clusters, perigynous, actinomorphic or zygomorphic. Hypanthium free from the ovary, tubular, urceolate or campanulate, usually appendiculate between the calyx lobes. Petals inserted near the orifice of the hypanthium, usually of the same number as the calyx lobes or reduced, generally spatulate, crumpled in aestivation. Stamens usually twice the number of calyx lobes or less, rarely more, sometimes heteromorphic, occasionally alternately unequal, posterior stamen sometimes reduced to a hypogynous gland; anthers included or exserted, generally versatile, dehiscing longitudinally. Ovary superior, sessile or stipitate, sometimes heteromorphic, generally bicarpellate, the placentation axile to free-central; style simple, sometimes heteromorphic, elongate or short; stigma capitate or bilobed. Fruit a dehiscent or indehiscent capsule; seeds sometimes winged, without endosperm, the embryo straight.

A family of 22 genera and about 500 species. Cosmopolitan but most abundant in tropical America.

a. Leaves and flowers without prominent black punctate glands; herbs, shrubs or trees.
b. Flowers relatively small, delicate, 3- to 6-merous; fruit a small membranaceous capsule; seeds wingless; herbs or shrubs.
c. Flowers 3- to 5-merous, actinomorphic or rarely obscurely zygomorphic, axillary; hypanthium turbinate or campanulate, about as long as broad, not gibbous or spurred; stamens inserted at one level; herbs.
d. Flowers usually solitary; leaves obtuse to attenuate at the base; capsule septicidally dehiscent ..... 1. ROTALA
dd. Flowers usually in clusters of 3, rarely 1 or 5; leaves auriculate at the base; capsule dehiscing irregularly ..... 2. AMMANNIA
cc. Flowers 6-merous, medianly zygomorphic, extra-axillary; hypanthium tubular, longer than broad, often gibbous or spurred at the base; stamens inserted at two levels; herbs or small shrubs ..... 3. CUPHEA
bb. Flowers massive, fleshy, 12- to 16-merous; fruit a large woody capsule; seeds winged; trees ..... 4. LAFOENSIA
aa. Leaves and flowers with prominent black punctate glands; shrubs or small trees ..... 5. ADENARIA

Members of two Asian genera have been introduced into Panama and are sometimes found as escapes. These genera are *Lawsonia* and *Lagerstroemia*. *Lawsonia inermis* L. is cultivated for ornament and because of the henna dye which is extracted from the leaves. *Lagerstroemia indica* L. and *Lagerstroemia speciosa* Pers., known as Crepe Myrtle, are widely cultivated as ornamentals because of their showy pink, purple or white flowers.

1. ROTALA L.

ROTALA L. Mant. 175. 1771.

Suffrenia Bellardi, in Act. Taurin. 7:445. 1794.
Boykinia Raf. Aut. Bot. 9. 1817, non Nutt.
Winterlia Spreng. Syst. 1:519, 788. 1825.
Ameletia DC. in Mém. Soc. Phys. Genève 3^2:82. 1826.
Nimmoia Wight, in Madr. Journ. Sci. 5:311. 1837.
Rhyacophila Hochst. in Flora 24:659. 1841.
Quartinia Endl. Gen. Suppl. 2:94. 1842.
Hydrolythrum Hook. Icon. Pl. n. s. 2: *t. 1007*. 1843.
Hypobrichia Benth. in Griseb. Cat. Pl. Cub. 108. 1886.

Aquatic or palustrine herbs, glabrous throughout, simple or sparsely branched. Leaves opposite or verticillate, sessile. Inflorescence of 1-flowered axillary cymes. Flowers usually 3- or 4-merous, bisexual, actinomorphic. Hypanthium appendiculate or exappendiculate, generally urceolate, membranaceous, the calyx lobes generally equal, valvate. Petals as many as the calyx lobes or absent. Stamens as many as the calyx lobes or fewer, equal, included, the anthers ovoid or oblong-ovoid, the filaments inserted about one-third from the base of the hypanthium. Ovary 3- or 4-carpellary, sessile or with a short gynophore, 1-locular, the placentation free-central; ovules many; stigma capitate. Fruit a horizontally striate septicidal capsule; style and hypanthium persistent; seeds minute.

About 38 species. America, Europe, Africa and Australia.

a. Plants palustrine; leaves and flowers decussate; hypanthium appendiculate, 2.5–5.0 mm. long; petals present ..... 1. R. RAMOSIOR
aa. Plants aquatic or palustrine; at least the upper leaves and flowers ternate; hypanthium exappendiculate, 0.5–1.0 mm. long; petals absent ..... 2. R. MEXICANA

Fig. 31. *Rotala mexicana*

1. ROTALA RAMOSIOR (L.) Koehne, in Mart Fl. Bras. 13^2:194, *t. 39, fig. 1.* 1877.

Ammannia ramosior L. Spec. Pl. ed. 1. 1:120. 1753.
Ammannia humilis Michx. Fl. Bor.-Amer. 1:99. 1803.
Boykinia humilis (Michx.) Raf. Aut. Bot. 9. 1817.
Ammannia ramosa J. Hill, in Veg. Syst. 11:14. 1824.
Peplis occidentalis Spreng. Syst. 2:135. 1825.
Ammannia catholica Cham. & Schlechtd. in Linnaea 2:378. 1827.
Ammannia occidentalis DC. Prod. 3:78. 1828.
Ammannia monoflora Blanco, Fl. Filip. ed. 1. 1:64. 1837.
Ammannia dentifera A. Gray, Pl. Wright. 2:55. 1853.
Rotala ramosior var. *interior* Fernald & Griscom, in Rhodora 37:169, *tab. 345, figs. 1 & 2.* 1935.
Rotala ramosior var. *dentifera* (A. Gray) Lundell, in Bull. Torr. Bot. Club 69:395. 1942.

Erect palustrine herbs to 3.5 dm. tall; branches somewhat angular at least toward the apex. Leaves elliptic or elliptic-oblanceolate, obtuse at the apex, cuneate to attenuate-cuneate at the base, 0.7–3.7 cm. long, 0.1–0.8 cm. wide. Flowers sessile, subtended by 2 linear bracts to 5 mm. long, 0.75 mm. wide. Hypanthium urceolate, 2.75–3.0 mm. long, 1.5–2.0 mm. broad at the orifice; calyx lobes broadly deltoid. Petals 0.7–1.25 mm. long, 0.6–0.75 mm. wide, white. Stamens as many as calyx lobes, minute, the anthers ovoid, about 0.3 mm. long, 0.3 mm. wide, the filaments to 1 mm. long. Ovary globose, 1.5–2.0 mm. long, sessile; style 0.2–0.5 mm. long. Seeds orbicular, about 0.25 mm. in diameter.

The United States, Central America, Antilles, Ecuador, Brazil, Philippine Islands.

CANAL ZONE: along the old Las Cruces Trail, between Fort Clayton and Corozal, *Standley 29053*. PANAMÁ: near Matías Hernández, *Standley 28936, 28987*; between Matías Hernández and Juan Díaz, *Standley 31996, 32013*; Juan Díaz, *Standley 30512, Killip 3273*.

2. ROTALA MEXICANA Cham. & Schlechtd. in Linnaea 5:567. 1830.

Rotala pusilla Tul. in Ann. Sci. Nat. 4 ser. 6:128. 1856.
Rotala apetala F. Muell. Fragm. 3:108. 1862.
Hypobrichia spruceana var. *tenuifolia* Griseb. Cat. Pl. Cub. 106. 1866.
Ammannia pygmea S. Kurz, in Seem. Journ. Bot. 5:376. 1867.
Rotala verticillaris Hiern, in Oliv. Fl. Trop. Afr. 2:467. 1871.
Rotala mexicana β *spruceana* Hiern, loc. cit. 1871.
Rotala mexicana subsp. *typica* var. α forma *minima* Koehne, in Mart. Fl. Bras. 13^2:195. 1877.
Rotala mexicana subsp. *typica* var. α forma *media* Koehne, loc. cit. 1877.
Rotala mexicana subsp. *typica* var. α forma *major* Koehne, loc. cit. 1877.
Rotala mexicana subsp. *typica* var. *spruceana* (Griseb.) Koehne, loc. cit. 1877.
Rotala mexicana subsp. *typica* Koehne, in Engl. Bot. Jahrb. 1:151. 1880.
Rotala mexicana subsp. *hierniana* Koehne, loc. cit. 1880.
Rotala mexicana subsp. *typica* var. *chamissoana* Koehne, in Engl. Pflanzenr. 4:30. 1903.
Rotala mexicana subsp. *pusilla* (Tul.) Koehne, loc. cit. 1903.

Creeping aquatic or palustrine herbs to 3 dm. tall, the branches obscurely angular. Leaves ternate, the submerged leaves linear, 3–18 mm. long, 0.5–3.0 mm. wide, the emersed leaves 3–8 mm. long, 1–2 mm. wide, both obtuse or retuse, cuneate-attenuate at the base. Flowers sessile, subtended by 2 setose bracteoles. Hypanthium urceolate, 0.6–1.0 mm. long, 0.5–0.6 mm. broad at the orifice; calyx

lobes narrowly deltoid, sometimes unequal. Petals absent. Stamens commonly 2, the anthers oblong-ovoid, about 0.1 mm. long, 0.25 mm. wide, the filaments about 0.4 mm. long. Ovary globose, abruptly narrowed into a short gynophore, 0.4 mm. long; style about 0.1 mm. long. Seeds suborbicular, about 0.3 mm. long, 0.25 mm. wide.

Central and South America, Asia, Africa and Australia. Found at low elevations in periodic streams and potholes.

CANAL ZONE: along the old Las Cruces Trail, between Fort Clayton and Corozal, *Standley 29222*; Darién Station, *Standley 31539*. CHIRIQUÍ: lower portion of valley and marshes along Río Antón, El Valle de Antón, about 500 m., *Hunter & Allen 366*. PANAMÁ: near Matías Hernández, *Standley 28989*; near the big swamp east of the Río Tecumen, *Standley 26715*; vicinity of Juan Franco Race Track, near Panamá, *Standley 27817*; along road between Panamá and Chepo, *Dodge, Hunter, Steyermark, & Allen 16721*; Las Sabanas, *Bro. Heriberto 151*; San José Island, Perlas Archipelago, East Harbor, *Johnston 830, Erlanson 459*.

Since this species is often found in periodic waters, two habits are found: an emersed and a submerged. *Rotala mexicana* flowers when the plants become emersed. Considerable difficulty is encountered in attempting to identify the submerged specimens. Identification, by means of vegetative characters only, is best accomplished by use of the obtuse or retuse leaf apex character.

2. AMMANNIA L.

AMMANNIA L. Sp. Pl. ed. 1. 1:119. 1753.

Cornelia Ard. Animadv. Specim. 2:9. 1764.
Cryptotheca Blume, in Bijdr. 1128, 1129. 1826.
Ditheca Miq. in Fl. Ind. Bat. 1:615. 1855.
Diplostemon Miq. loc. cit. 1855.
Hapalocarpum Miq. loc. cit. 1855.
Ammannella Miq. loc. cit. 618. 1855.

Annual herbs, simple or sparsely branched, the young branches obscurely tetragonal. Leaves opposite, sessile. Inflorescence of (1- to) several-flowered cymes gathered into axillary clusters; flowers (5-, 6- or) 4-merous, bisexual, actinomorphic. Hypanthium urceolate, appendiculate or exappendiculate, the calyx lobes valvate. Petals present or absent. Stamens of the same or twice the number of calyx lobes or less, inserted about a third from the base of the hypanthium. Ovary generally 4-carpellary, superior, sessile, the placentation generally axile; ovules many; style sometimes obsolete; stigma capitate. Fruit an irregularly dehiscent ovoid capsule, the hypanthium and style persistent; seeds many, minute.

About 20 species. America, Europe, Asia, Africa, Hawaiian and Mariana Islands. Only one indigenous and one introduced species in Panama.

a. Petals present; hypanthium appendiculate; stamens exserted..... 1. A. COCCINEA
aa. Petals absent; hypanthium exappendiculate; stamens included..... 2. A. LATIFOLIA

1. AMMANNIA COCCINEA Rottb. in Pl. Hort. Univ. Havn. Programm. 7. 1773.

Ammannia ramosior acc. to L. Mant. 2:332. 1771, not L. Spec. Pl. ed. 1.
Ammannia purpurea Lam. Encl. 1:131. 1783.

Ammannia sanguinolenta Swartz, Fl. Ind. Occ. 1:272. 1797.
Ammannia octandra acc. to Cham. & Schlechtd. in Linnaea 2:376. 1827, not L.
Ammannia stylosa Fisch. & Mey. in Ind. Sem. Hort. Petrop. 7:41. 1841.
Ammannia robusta Heer & Reg. in Ind. Sem. Hort. Turic. 1842, *adn. 1.*
Ammannia texana Scheele, in Linnaea 21:588. 1846.
Ammannia sanguinolenta subsp. *purpurea* Koehne, in Mart. Fl. Bras. 13^2:207, *t. 40, f. 4.* 1877.
Ammannia sanguinolenta subsp. *robusta* Koehne, loc. cit. 208, *t. 40, f. 4b.* 1877.
Ammannia sanguinolenta subsp. *longifolia* Koehne, loc. cit. 208. 1877.
Ammannia coccinea subsp. *robusta* (Heer & Reg.) Koehne in Engl. Bot. Jahrb. 1:250. 1880.
Ammannia coccinea subsp. *longifolia* Koehne, loc. cit. 1880.
Ammannia pubiflora Sosn. in Bull. Mus. Cauc., Tiflis, 8:165. 1915.

Erect slender herbs to 4 dm. tall, glabrous throughout, the stems angular. Leaves sessile, narrowly oblong, acute at the apex, auriculate-amplexicaul at the base, 1.5–6.5 cm. long, 0.2–1.3 cm. wide, the veins obscure. Inflorescence spiciform, leafy-bracted, the flowers in subsessile 1- to 3-flowered minutely bracteate cymes. Hypanthium urceolate, exappendiculate, becoming globose in fruit, 2.5–3.5 mm. long, about 2 mm. broad at the orifice, the calyx lobes generally unequal. Petals as many as calyx lobes, about 1.5 mm. long, 1.25 mm. wide, violet. Stamens exserted, the filaments glabrous, the anthers about 0.5 mm. long. Ovary ovoid, about 1.5–2.5 mm. long, 1.5 mm. in diameter, glabrous; style 1.5–2.5 mm. long.

The United States, Central and South America, Antilles; Hawaiian, Mariana, and Philippine Islands. Believed introduced into Panama in hay from Texas.

PANAMÁ: San José Island, Perlas Archipelago, *Johnston 1239.*

2. AMMANNIA LATIFOLIA L. Spec. Pl. ed. 1. 1:119. 1753.

Ammannia lythrifolia Salisb. Prodr. 65. 1796.
Isnardia subhastata Ruiz & Pav. Fl. Peruv. 1:66, *t. 86.* 1798.
Jussiaea sagittata Poir. in Lam. Encycl. Suppl. 3:198. 1818.
Ammannia ramosior Ell. Sketch 1:219. 1821.
Ammannia pallida Lehm. in Ind. Sem. Hort. Hamburg 3. 1823.
Ammannia sagittata DC. Prodr. 3:80. 1828.
Ammannia hastata DC. loc. cit. 78. 1828.
Ammannia humilis var. β Torr. & Gray, in Fl. N. Amer. 1:480. 1838–1840.
Ammannia catholica Hook. & Arn. Bot. Beechey's Voy. 289. 1841, acc. Seemann.
Ammannia lingulata Griseb. Cat. Pl. Cub. 106. 1866.
Ludwigia scabriuscula Kellogg, in Proc. Calif. Acad. 7:78. 1876.

Erect slender herbs to 4.5 dm. tall, glabrous throughout. Leaves sessile, narrowly oblong-lanceolate, acute at the apex, auriculate-amplexicaul at the base, 3.0–8.5 cm. long, 0.4–1.3 cm. wide, the primary lateral veins and submarginal vein obscure. Inflorescence spiciform, leafy-bracted, intercalary, the flowers in relatively distant, subsessile, 1- to 3-flowered minutely bracteolate cymes. Hypanthium urceolate, appendiculate, becoming globose in fruit, 2.4–4.0 mm. long, 1–2 mm. broad at the orifice, the calyx lobes broadly deltoid. Petals absent. Stamens included, the filaments glabrous, the anthers about 0.25 mm. long. Ovary ovoid, 1.5–3.5 mm. long, 1.0–2.5 mm. in diameter, glabrous; style about 0.5 mm. long.

Southern United States, Central and South America, Antilles.

PANAMÁ: Bella Vista, at sea level, *Killip 12031.*

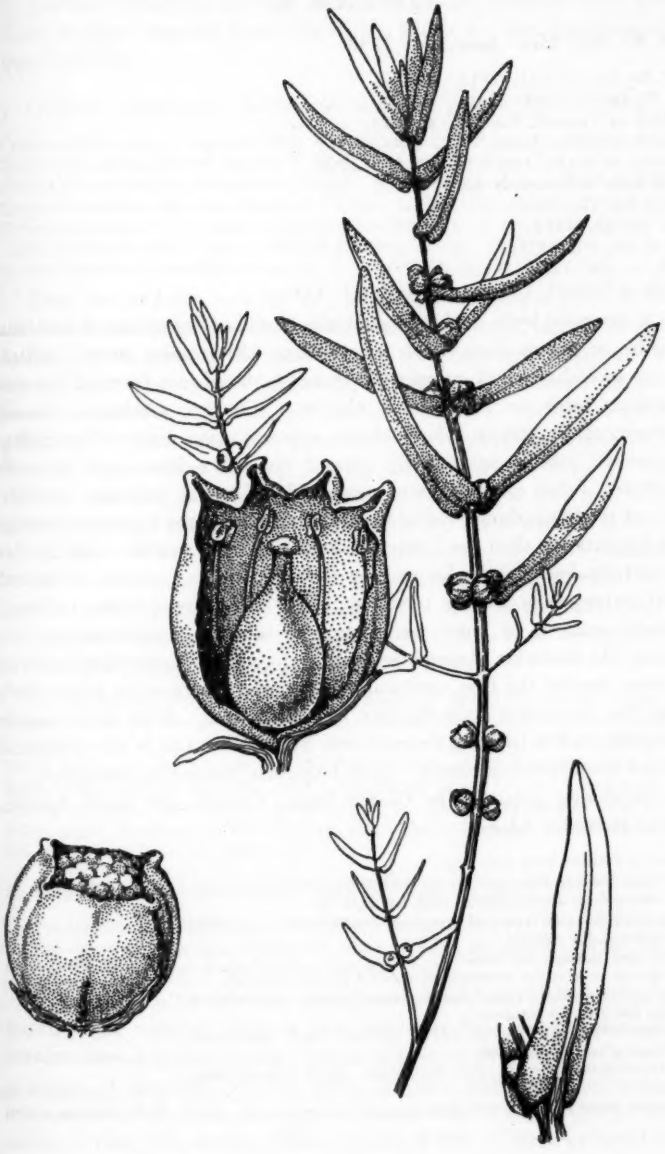

Fig. 32. *Ammannia latifolia*

3. CUPHEA P. Br.

CUPHEA P. Br. Nat. Hist. Jam. 216. 1756.

Melanium P. Br. loc. cit. 215. 1756.
Parsonsia P. Br. loc. cit. 199. 1756.
Balsamona Vell. in Vandelli, Fasc. *pl. 15*. 1771.
Silene Leavenw. in Sillim. Journ. 7:62. 1799.
Melvilla Anders. in Journ. Arts & Sci. 25:207. 1807.
Bergenia Raf. Sylv. Tellur. 102. 1838.
Endecaria Raf. loc. cit. 1838.
Quirina Raf. loc. cit. 1838.
Dipetalon Raf. loc. cit. 1838.
Melfona Raf. loc. cit. 1838.
Maja Klotzsch, in Schomb. Fl. Fauna Guian. 1191. 1848.

Annual or perennial herbs or shrubs, generally branched, sometimes rhizomatous. Leaves opposite or approximate, sessile or petiolate; the stipules setose. Inflorescence of 1- to several-flowered interpetiolar cymes gathered into terminal bracteate or leafy paniculiform or racemiform clusters. Flowers 6-merous, bisexual, medianly zygomorphic. Hypanthium tubular, appendiculate, more or less gibbous, sometimes spurred, ribbed, occasionally colored, the calyx lobes equal or rarely unequal, valvate. Petals spatulate, 6 or rarely reduced to the posterior 2, inserted at the orifice of the hypanthium, red to violet. Stamens 11, the 2 posterior inserted lower in the hypanthium than the 9 anterior, included, the 9 anterior equal or when unequal the antesepalous stamens longer than the antepetalous, included or exserted, the posterior antesepalous stamen modified into a basal hypogynous, unilateral, ovate to ovate-reniform or more rarely strongly involute-cupuliform disc, the anthers oblong, the filaments glabrous or pubescent. Ovary bicarpellary, superior, sessile, bilocular toward the base, unilocular above, the placentation incompletely axile; ovules few to many; style slender; stigma capitate. Fruit a unilaterally loculicidal capsule enclosed within the persistent hypanthium which also is ruptured by the reflexed protuberant placenta. Seeds lenticular, sometimes marginate.

A very perplexing genus. The United States, Central and South America, Galapagos and Hawaiian Islands.

a. Hypanthium at anthesis 4–10 mm. long.
  b. Flowers ebracteolate; disc cupuliform; seeds more than 20 ..... 1. C. UTRICULOSA
  bb. Flowers bracteolate; disc unilateral; seeds less than 10.
    c. Cymes gathered into terminal bracteate racemiform or paniculiform clusters; disc reflexed.
      d. Style and stamens included ..... 2. C. SETOSA
      dd. Style and at least the antesepalous stamens greatly exserted ..... 3. C. EPILOBIFOLIA
    cc. Cymes gathered into terminal foliate racemiform or paniculiform clusters; disc erect to horizontal.
      e. Hypanthium not spurred, merely gibbous; seeds emarginate; plants often rhizomatous ..... 4. C. CALOPHYLLA
      ee. Hypanthium spurred; seeds marginate; plants seldom rhizomatous ..... 5. C. CARTHAGENENSIS
aa. Hypanthium at anthesis 22–35 mm. long ..... 6. C. INFUNDIBULUM

Cuphea rotundifolia Koehne, resembling *C. calophylla* but with more rotundate leaves, has been reported from Panama but I have not seen specimens of this species from that area.

1. CUPHEA UTRICULOSA Koehne, in Mart. Fl. Bras. 13^2:452. 1877.

Cuphea gracilis acc. to Seemann, Bot. Voy. Herald, 121. 1852–57, not Benth.
Cuphea panamensis Hemsl. Diagn. Pl. Nov. Mex. 3:52. 1880.
Cuphea utriculosa var. *panamensis* (Hemsl.) Koehne, in Engl. Bot. Jahrb. 1:452. 1881.
Cuphea utriculosa var. *donnell-smithii* Koehne, in Bot. Gaz. 18:203. 1893.
Cuphea utriculosa var. α forma *communis* Koehne, in Engl. Pflanzenr. 4:108. 1903.
Cuphea utriculosa var. α forma *ciliifolia* Koehne, loc. cit. 1903.
Parsonsia utriculosa Standl. in Contrib. U. S. Natl. Herb. 23:1017. 1924.

Erect slender herbs to 4 dm. tall, sometimes subligneous near the base; branches with minutely tomentose lines decurrent from the paired nodes above. Leaves oblong-elliptic, acute at the apex, cuneate-attenuate at the base, 0.4–6.0 cm. long, 0.2–1.1 cm. wide, sessile or subsessile, both surfaces glabrous, the primary lateral veins inconspicuous, the margin minutely ciliate. Flowers decussate, solitary; pedicels 4–13 mm. long, bracteoles absent. Hypanthium subampullaceous, 5.5–8.0 mm. long, median diameter 1.5–2.5 mm., transverse at the orifice, gibbous at the base, minutely puberulent, the posterior calyx lobe enlarged. Petals 6, the 2 posterior 2.5–4.5 mm. long, 1.5–2.0 mm. wide, the 2 anterior 3.0–5.5 mm. long, 1.5–2.5 mm. wide; violet. Stamens 11, the anterior 9 equal, included, the lower half of the filaments pubescent; disc cupuliform, split anteriorly. Ovary broadly ovoid, 2.5–3.25 mm. long, villous; style 1–2 mm. long, villous, included. Seeds 24–36, suborbicular, around 1 mm. long, 0.75 mm. wide, emarginate.

Southern Mexico to Panama in moist habitats.

CANAL ZONE: near Fort Randolph, *Standley 29848*; drowned forest of Quebrada Bonita, 70–80 m., *Dodge & Allen s. n.*; drowned forest of Quebrada Culebra, 70–75 m., *Dodge & Allen 17049*; Chivi-Chivi River, near Aguarubia, *Killip 33665*; forest between Peluca Hydrographic Station and Quebrada Peluca, along Río Boquerón, 70– m., *Steyermark & Allen 17233*; drowned forest of Quebrada Ancha, 70 m., *Steyermark & Allen s. n.*; Río Paraíso above East Paraíso, *Standley 29877*. COCLÉ: vicinity of Ola, alt. 100–350 m., *Pittier 5032*; Bismarck, 2000–3000 ft. elev., above Penonomé, *Williams 264*. PANAMÁ: Río La Maestra, 0–25 m., *Allen 30*.

2. CUPHEA SETOSA Koehne, in Mart. Fl. Bras. 13^2:223. 1877.

Cuphea rigidula acc. to Seemann, Bot. Voy. Herald, 121. 1852–57, not Benth.
Cuphea setosa var. α forma *seemannii* Koehne, in Engl. Bot. Jahrb. 1:456. 1881.
Cuphea setosa var. *glabrescens* Koehne, loc. cit. 1881.

Erect herbs to 3.8 dm. tall, subligneous at least near the base, the branches with brown hispid recurved hairs in lines decurrent from the paired nodes above, area between lines grayish-strigose. Leaves elliptic to ovate-elliptic, acute at the apex, attenuate at the base, 3–9 cm. long, 1–3 cm. wide, both surfaces strigose with interspersed setose hairs, the primary lateral veins arcuate, almost forming a submarginal vein, the margin ciliate; stipules setose. Cymes gathered into terminal, bracteate, racemiform, rarely paniculiform, clusters. Flowers decussate, solitary, infra-interbracteal; bracts elliptic, to 2.5 mm. long, 1 mm. wide, coarsely ciliate,

Fig. 33. *Cuphea utriculosa*

caducous; peduncle 0.5–1.0 mm. long; pedicel 1.25–2.0 mm. long; bracteoles 2, minute, sometimes caducous. Hypanthium ampullaceous, 5.0–6.5 mm. long, median diameter about 1.5 mm., oblique at orifice, spur straight, hispid without, tomentose within, sometimes insect-infested and becoming swollen and bladdery. Petals 6, 1.5–2.0 mm. long, 0.75–1.0 mm. wide, violet. Stamens 11, the anterior 9 alternately unequal, included, the anthers oblong, to 0.5 mm. long, the filaments tomentose with the exception of the 3 anterior antesepalous; disc unilateral, strongly reflexed. Ovary narrowly ovoid, 1.0–1.25 mm. long, 0.5–0.75 mm. in diameter, tomentose; style 1.5–2.5 mm. long, tomentose, included. Seeds 4, almost cordiform, 1.5 mm. long, 1.5 mm. wide, emarginate.

Central America, Colombia, Peru, Bolivia.

CANAL ZONE: forest between Peluca Hydrographic Station and Quebrada Peluca, along Río Boquerón, 70– m., *Steyermark & Allen 17258*.

3. CUPHEA EPILOBIFOLIA Koehne, in Mart. Fl. Bras. 13^2:223. 1877.

Cuphea epilobifolia var. *costaricensis* Koehne, in Engl. Bot. Jahrb. 1:457. 1881.
Cuphea epilobifolia var. *costaricensis* forma *canescens* Koehne, in Bot. Gaz. 20:4. 1895.
Cuphea epilobifolia var. *costaricensis* forma *tonduzii* Koehne, in Engl. Bot. Jahrb. 39:156. 1900.
Cuphea epilobifolia var. *venezuelana* Koehne, in Engl. Pflanzenr. 4:112. 1903.
Cuphea epilobifolia var. *venezuelana* forma *gollmeri* Koehne, loc. cit. 1903.
Cuphea epilobifolia var. *venezuelana* forma *lindenii* Koehne, loc. cit. 1903.
Cuphea epilobifolia var. *costaricensis* forma *hoffmannii* Koehne, in Engl. Pflanzenr. 4:112. 1903.
Cuphea epilobifolia var. *costaricensis* forma *endresii* Koehne, loc. cit. 113. 1903.
Cuphea epilobifolia var. *caquetae* Sprague, in Ann. Bot. 17:161, *t. 11, f. 1–6*. 1903.
Parsonsia epilobifolia Standl. in Contrib. U. S. Natl. Herb. 23:1018. 1924.

Woody shrubs to 2 m. tall, apical portions of branches densely wooly or at least with tomentose lines decurrent from the paired nodes above. Leaves elliptic, sessile or subsessile, acute at the apex, attenuate at the base, 3–14 cm. long, 0.8–3.0 cm. wide, both surfaces puberulent to strigose, the costa glabrous to brown-strigose beneath, the submarginal vein sometimes conspicuous, sometimes bearing brown strigose hairs, the margin entire; stipules somewhat persistent. Cymes gathered into terminal bracteate racemiform or paniculiform clusters; flowers decussate, infra-interbracteal; bracts lanceolate, to 4 mm. long, 1.5 mm. wide, puberulent, coarsely ciliate, caducous; peduncle 0.75–1.0 mm. long; pedicel 1–5 mm. long; bracteoles 2, minute. Hypanthium ampullaceous, 4.0–7.5 mm. long, median diameter 0.75–1.5 mm., oblique at the orifice, the spur straight to recurved, densely strigose or hirsute, sometimes insect-infested and becoming swollen and bladdery. Petals 6, 1.25–2.0 mm. long, 0.25–1.25 mm. wide, pink to violet. Stamens 11, the anterior 9 alternately unequal, antesepalous exserted, antepetalous included to slightly exserted, the filaments villous except for the 3 anterior antesepalous, or all glabrous; disc unilateral, strongly reflexed. Ovary broadly ovoid, 1.5–2.5 mm. long, villous; style 2.75–5.5 mm. long, villous, exserted. Seeds 4–6, suborbicular to orbicular, 1.0–1.5 mm. long, 1.0–1.5 mm. wide, emarginate to slightly marginate.

Costa Rica, Panama, Venezuela.

BOCAS DEL TORO: Changuinola Valley, *Dunlap 215a*; *Carleton 215*; Fish Creek Hills, vicinity of Chiriquí Lagoon, *Von Wedel 2194, 2458*; Sibubi Falls, Sixaola Valley, *Rowlee & Rowlee 379*. COCLÉ: vicinity of El Valle, 800–1000 m., north rim, *Allen 215*; north rim of El Valle de Antón, near Cerro Turega, alt. 650–700 m., *Woodson & Schery 161*; El Valle de Antón, floor, vicinity Finca Tomás Árias, alt. 600 m., *Allen 3624*; El Valle de Antón, along Río Indio trail, 500–700 m., *Hunter & Allen 359*. CANAL ZONE: forest between Peluca Hydrographic Station and Quebrada Peluca, along Río Boquerón, 70– m., *Steyermark & Allen 17236*.

4. CUPHEA CALOPHYLLA Cham. & Schlechtd. in Linnaea 2:361. 1827.

Cuphea plumbaginea Mart. in Flora Beibl. 21^2:62. 1838.
Cuphea antisyphilitica acc. to Seemann, Bot. Voy. Herald, 121. 1852–57, not HBK.
Cuphea orthodisca Koehne, in Mart. Fl. Bras. 13^2:224. 1877.
Cuphea microstyla Koehne, loc. cit. 1877.
Cuphea calophylla var. *calophylla* Koehne, in Engl. Bot. Jahrb. 2:138. 1881.
Cuphea calophylla var. *calophylla* forma *deformis* Koehne, loc. cit. 1881.
Cuphea calophylla var. *orthodisca* Koehne, loc. cit. 1881.
Cuphea calophylla var. *microstyla* Koehne, loc. cit. 139. 1881.
Cuphea calophylla var. *calophylla* forma *breuningii* Koehne, in Engl. Bot. Jahrb. 29:156. 1900.
Cuphea calophylla var. *calophylla* forma *plumbaginea* (Mart.) Koehne, in Engl. Pflanzenr. 4:116. 1903.
Parsonsia calophylla Standl. in Contrib. U. S. Natl. Herb. 23:1018. 1924.

Erect or sprawling herbs to 5.5 dm. tall, rhizomatous, the branches wooly interspersed with occasional large red hairs, scabrous. Leaves lanceolate to elliptic-lanceolate, acute at the apex, obtuse at the base, 0.8–4.0 cm. long, 0.1–2.0 cm. wide, reduced toward the apex, above glabrous to puberulous and strigose, beneath strigose and scabrous, margin minutely ciliate, primary lateral veins slightly arcuate; petiole 1–5 mm. long. Cymes gathered into terminal foliate racemiform or paniculiform clusters, the flowers alternately interpetiolar, solitary; peduncle 3.5–7.0 mm. long; pedicel about 0.25 mm. long; bracteoles 2, minute. Hypanthium subampullaceous, 4–7 mm. long, median diameter about 1.25 mm., transverse at the orifice, gibbous at the base, white puberulent with interspersed red hairs. Petals 6, 2.5–3.0 mm. long, 1.5–2.0 mm. wide, violet. Stamens 11, the anterior 9 alternately unequal, included, the filaments densely villous; disc unilateral, not reflexed. Ovary broadly ovoid, 1.5–3.0 mm. long, greatly elongating in fruit, glabrous; style 1.0–1.5 mm. long, glabrous or villous, included, becoming exserted in fruit. Seeds 5–9, suborbicular, 1.0–1.8 mm. long, 1.0–1.5 mm. wide, emarginate.

Central America, Brazil.

CANAL ZONE: Chagres, *Fendler 111, 223*; between Chagres Batteries and Fort San Lorenzo, Fort Sherman Military Reservation, *Maxon & Valentine 7025*; rocky banks of Chagres at El Vigía, *Pittier 2376, 2377*; drowned forest of Quebrada below Río Indio Hydrographic Station, 70 m., *Steyermark 17396*; forest between Peluca Hydrographic Station and Quebrada Peluca, along Río Boquerón, 70– m., *Steyermark & Allen 17231*; around Gamboa, alt. 20–100 m., *Pittier 4794*; along the old Las Cruces Trail, between Fort Clayton and Corozal, *Standley 29085*; vicinity of Monkey Hill, *Cowell 30*; Cocoli, *Riley 129*; Balboa, *Standley 29257, 25455*; Ancón Hill, *Standley 25193, Killip 3040, Johansen 26*; Cerro Ancón, *Bro. Heriberto 127*; Mount Hope Cemetery, *Standley 28764*; Juan Minas, *Piper 5704*. COCLÉ: Penonomé and vicinity, 50–1000 ft. elev., *Williams 150*. COLÓN: between France Field and Catival, *Standley 30417*. DARIÉN: headwaters Río Chico, 500–750 ft., *Allen 4611*. PANAMÁ: forests of the upper Mamoní River, alt. 150–400 m., *Pittier 4481*; Orange River Valley, vicinity of Juan Díaz, *Killip 3330*.

5. CUPHEA CARTHAGENENSIS (Jacq.) Macbr. in Field Mus. Publ. Bot. 8:124. 1930.

Lythrum carthagenensis Jacq. Stirp. Amer. Hist. 148. 1763.
Balsamona pinto Vand. Fasc. *pl. 15*. 1771.
Cuphea balsamona Cham. & Schlechtd. in Linnaea 2:363. 1827.
Cuphea elliptica var. α Koehne, in Engl. Bot. Jahrb. 2:145. 1881.
Parsonsia pinto Heller, in Minn. Bot. Stud. 9:862. 1897.

Erect herbs to 4.5 dm. tall, sometimes subligneous near the base, simple to alternately branched, the branches generally glandular-hirsute with interspersed white tomentose hairs becoming hispid toward the apex. Leaves lanceolate to ovate or elliptic, acute at the apex, cuneate or attenuate at the base, 1.0–5.5 cm. long, 0.4–2.1 cm. wide, both surfaces strigose and scabrous, upper surface sometimes also puberulent, the margin ciliate, the primary lateral veins arcuate; petiole 0.1–0.3 mm. long; stipules minute. Cymes gathered into terminal foliate racemiform or paniculiform clusters, the leaves subtending the flowers gradually reduced above, setose-ciliate, both surfaces strigose and scabrous. Flowers interpetiolar, generally solitary; peduncle 0.5–1.2 mm. long; pedicel 0.25–0.75 mm. long; bracteoles 2, minute. Hypanthium subampullaceous or ampullaceous, 2.5–7.0 mm. long, the median diameter around 1.25 mm., transverse at the orifice, spur straight, with glandular hirsute pubescence generally restricted to the ribs, sometimes shortly villous toward the base. Petals 6, 1.25–2.0 mm. long, about 0.5 mm. wide, violet to purple. Stamens 11, the anterior 9 alternately unequal, included, the filaments glabrous or villous; disc not reflexed. Ovary broadly ovoid, 2–3 mm. long, glabrous; style 0.5–1.0 mm. long, included, glabrous. Seeds 3–7, orbicular to elliptic, 1.0–2.5 mm. long, 0.75–2.0 mm. wide, marginate.

The United States, Central and South America; Antilles; Hawaii. The presence of this species in Hawaii is probably the result of introduction.

BOCAS DEL TORO: Isla Colón, alt. 0–120 m., southwest of Bocas at Macaw Hills, *Von Wedel 525*; Macaw Hill, swampland, *Von Wedel 4*; vicinity of Chiriquí Lagoon, *Von Wedel 2494*. CANAL ZONE: Gatún, *Piper 5996*; near Gatún, *Standley 27316*; Barro Colorado Island, *Bailey & Bailey 500, Aviles 60, Starry 272, Kenoyer 464, Duchassaing s. n.*; between Las Cascadas and Bas Obispo, along the railroad, altitude 50 m., *Pittier 3747*; Old Panamá, *Riley 150, 151*. CHIRIQUÍ: Boquete, el. 3800 ft., *Davidson 577, 673*; vicinity of Boquete, alt. 1200–1500 m., *Woodson & Schery 767, 803*; vicinity of Cerro Punta, 1500–2000 m., *Seibert 252*; llanos del Volcán, 1120–1200 m., *Seibert 350*. COLÓN: between France Field, Canal Zone and Catival, *Standley 30415*. PANAMÁ: Bella Vista, at sea level, *Killip 12035*; wet savanna east of Pacora, ca. 25 m., *Woodson, Allen & Seibert 728*; thickets and forests near Arraiján, ca. 15 m., *Woodson, Allen & Seibert 1369*; Chepo, alt. about 60 m., *Pittier 4463, 4463a*; Laguna de Portala, near Chepo; alt. 50 m., *Pittier 4620*; Río Tecumen, *Standley 29456*; Sabanas, *Bro. Paul 51*; Isla Taboga, ca. 0–186 m., *Woodson, Allen & Seibert 1433*; San José Island, Perlas Archipelago, *Johnston 988, Erlanson 499*.

Examination of the type material of *Cuphea elliptica* reveals much disparity between the specimens and the original description, but it does fall well within the range of measurements of *C. carthagenensis*. I have been unable to find any character or combination of characters to distinguish *C. elliptica* var. α from *C. carthagenensis*. The characters formerly employed can be shown to be unreliable. I feel certain that only one species is represented.

6. CUPHEA INFUNDIBULUM Koehne, in Mart. Fl. Bras. 13^2:236. 1877.

Cuphea appendiculata acc. to Seemann, in Bot. Voy. Herald, 121. 1852–57, not Benth.
Cuphea infundibulum var. *foliosa* Koehne, in Engl. Bot. Jahrb. 7:43. 1885.

Erect slender herbs to 2.5 m. tall, subligneous at least near the base, branches white-puberulent interspersed with yellow hispid hairs at least near the apex. Leaves broadly elliptic, acuminate, obtuse and abruptly decurrent at the base, 3–13 cm. long, 1.5–4.5 cm. wide, above puberulent and scabrous, beneath strigose, with a well-developed submarginal vein, margin minutely ciliate; petiole to 5 (–12) mm. long. Flowers in young plants solitary, interpetiolar, transitional in fully mature plants to cymes gathered into terminal bracteate paniculiform clusters; bracts elliptic, 2.5–5.0 mm. long, 1.0–2.5 mm. wide, both surfaces sericeous, caducous. Peduncle 1–4 mm. long; pedicel 0.75–1.5 mm. long; bracteoles 2, minute. Hypanthium infundibuliform, 23–35 mm. long, median diameter 2.6–3.0 mm., transverse at the orifice, at most slightly gibbous at the base, the lower third yellowish-green, puberulent and hirsute, the upper two-thirds salmon-red, puberulent. Petals 2, posterior, 2.5–3.25 mm. long, 1.0–1.75 mm. wide, red. Stamens 11, the anterior 9 alternately unequal, exserted, the filaments glabrous; disc unilateral, semi-cupuliform at the base, not reflexed. Ovary very narrowly ovoid, 3–8 mm. long, glabrous; style 2.3–3.0 mm. long, glabrous, exserted. Seeds 5–7, suborbicular, about 2.5 mm. long, 2 mm. wide, emarginate.

Costa Rica, Panama.

CHIRIQUÍ: llanos on slopes of Volcán de Chiriquí and along Río Chiriquí Viejo, 1200 m., *Allen 998*; trail from Paso Ancho to Monte Lirio, upper valley of Río Chiriquí Viejo, alt. 1500–2000 m., *Allen 1510*; rocky plains about 5 miles south of Boquete, alt. 3000 ft., *Allen 4710*; Bajo Mono, Boquete District, el. 4500 ft., *Davidson 489*; El Boquete, alt. 1450 m., *Killip 3552*; vicinity of El Boquete, alt. 900–1200 m., *Bro. Maurice 689*; forests along Río Ladrillo and vicinity, above El Boquete, alt. 1200–1300 m., *Maxon 5392*; pastures around El Boquete, alt. 1000–1300 m., *Pittier 2883*; between Cerro Vaca and Hato del Loro, eastern Chiriquí, alt. 850–1100 m., *Pittier 5383*; valley of the upper Río Chiriquí Viejo, vicinity of Monte Lirio, 1300–1900 m., *Seibert 304*; valley of the upper Río Gariché, 1050–1100 m., *Seibert 333*; vicinity of Casita Alta, Volcán de Chiriquí, ca. 1500–2000 m., *Woodson, Allen & Seibert 862*; Finca Lérida to Boquete, ca. 1300–1700 m., *Woodson, Allen & Seibert 1133*.

4. LAFOENSIA Vand.

LAFOENSIA Vand. Fl. Lusit. & Bras. Specim. 33. 1788.

Calyplectus Ruiz & Pav. Peruv. & Chil. Prodr. 73. 1794.

Small trees, the young branches more or less tetragonal, becoming terete with age. Leaves opposite, petiolate, glandular, stipulate. Inflorescence of 1-flowered cymes gathered into terminal leafy racemiform or rarely paniculiform clusters. Flowers usually 12- to 16-merous, bisexual, actinomorphic. Hypanthium generally campanulate with alternate coriaceous teeth between the equal, conduplicate-valvate calyx lobes, the appendages absent. Petals inserted slightly below the orifice of the hypanthium, as many as the calyx lobes, spatulate, white to yellow. Stamens generally twice the number of calyx lobes, exserted, the anthers oblong-linear, the

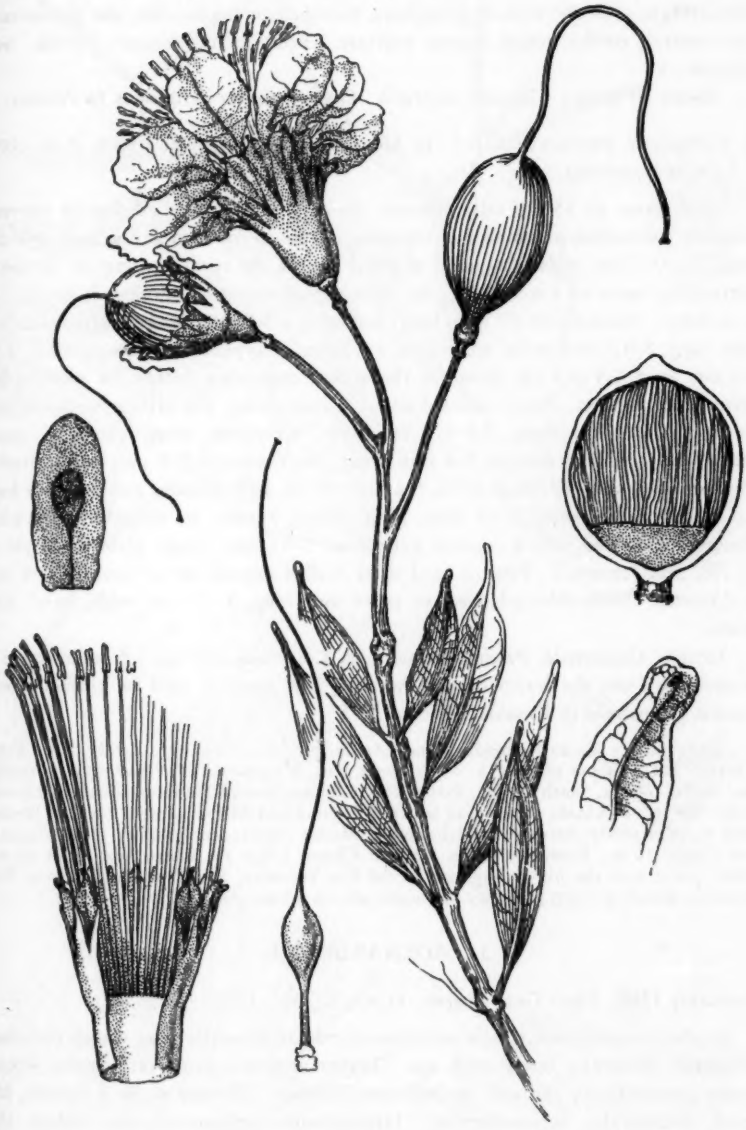

Fig. 34. *Lafoensia punicifolia*

filaments united at the base into a fleshy perigynous cup continuous with the hypanthium. Ovary with a gynophore, bicarpellate, unilocular, the placentation free-central; ovules many; stigma capitate. Fruit an indehiscent capsule; seeds winged.

About 10 species. Mexico to Brazil. Only 1 species indigenous to Panama.

1. LAFOENSIA PUNICIFOLIA DC. in Mém. Soc. Phys. Genève 3^2:86, *t. 1.* 1828 (as *punicaefolia*).

Small trees to 15 m. tall, glabrous throughout. Leaves elliptic to obovate, obtusely subcaudate-acuminate at the apex, obtuse to rounded at the base, 5–9 cm. long, 1.0–3.5 cm. wide, the gland at distal end of the costa opening on the lower surface by means of a small pore, the submarginal vein well developed; petiole 5–6 mm. long. Peduncle 19–27 mm. long; pedicel 2.5–5.0 mm. long; bracteoles 2, 5–7 mm. long, 8–12 mm. wide, coriaceous, caducous. Hypanthium campanulate, 2.5–4.0 cm. long, 2.5–3.5 cm. broad at the orifice, coriaceous except the more or less deltoid calyx lobes. Petals inserted about 5 mm. below the orifice of the hypanthium, 2.7–3.0 cm. long, 0.8–1.5 cm. wide, sometimes erose. Stamens equal, greatly exserted, the anthers 7–8 mm. long, the filaments 7–9 cm. long, inserted at one level about one-third above the base of the hypanthium, contorted in bud, red. Ovary turbinate, 5–10 mm. long, about 5 mm. in diameter, somewhat abruptly narrowed into a cuneate gynophore 5–11 mm. long, glabrous; style to 10 cm. long, exserted. Fruit a hard thick-walled capsule to 6.5 cm. long, 4 cm. in diameter. Seeds oblong-lanceolate, to 40 mm. long, 5–15 mm. wide; cotyledons ovate.

Mexico, Guatemala, Panama, Venezuela, Colombia, Bolivia. A yellow dye is extractable from the leaves of this species. The wood is used in cabinet work. Known as *amarillo* in Panama.

CANAL ZONE: Barro Colorado Island, *Aviles 28b, Shattuck 437, Zetek 3616*; Barro Colorado Island, shore of cove S. of Fr. Lock site, *Woodworth & Vestal 475*. DARIÉN: Real de Sta. Marta, South Darién, *Pittier 6985*; forests around Pinogana, southern Darién, *Pittier 6985a*. PANAMÁ: along road between Panamá and Chepo, *Dodge, Hunter, Steyermark & Allen 16705*; between Las Sabanas and Matías Hernández, *Standley 31907*; Sabanas near Chepo, 30 m., *Hunter & Allen 24*; near Chepo, *Kluge 18*; Chepo, alt. about 60 m., *Pittier 4763*; near the big swamp east of the Río Tecumen, *Standley 26558, 26705*; Río Tecumen, *Standley 29437*; vicinity of Pacora, alt. ca. 35 m., *Allen 1006*.

5. ADENARIA HBK.

ADENARIA HBK. Nov. Gen. & Spec. 6:185, *t. 549.* 1823.

Shrubs or small trees, black punctate-glandular generally, the young branches tetragonal, becoming terete with age. Leaves opposite, petiolate; stipules setose. Cymes gathered into axillary umbelliform clusters. Flowers 4- or 5-merous, bisexual, heterostylic, actinomorphic. Hypanthium campanulate, not ribbed, the calyx lobes more or less equal, valvate; exappendiculate. Petals inserted at the orifice of the hypanthium, as many as calyx lobes, rose or white. Stamens usually

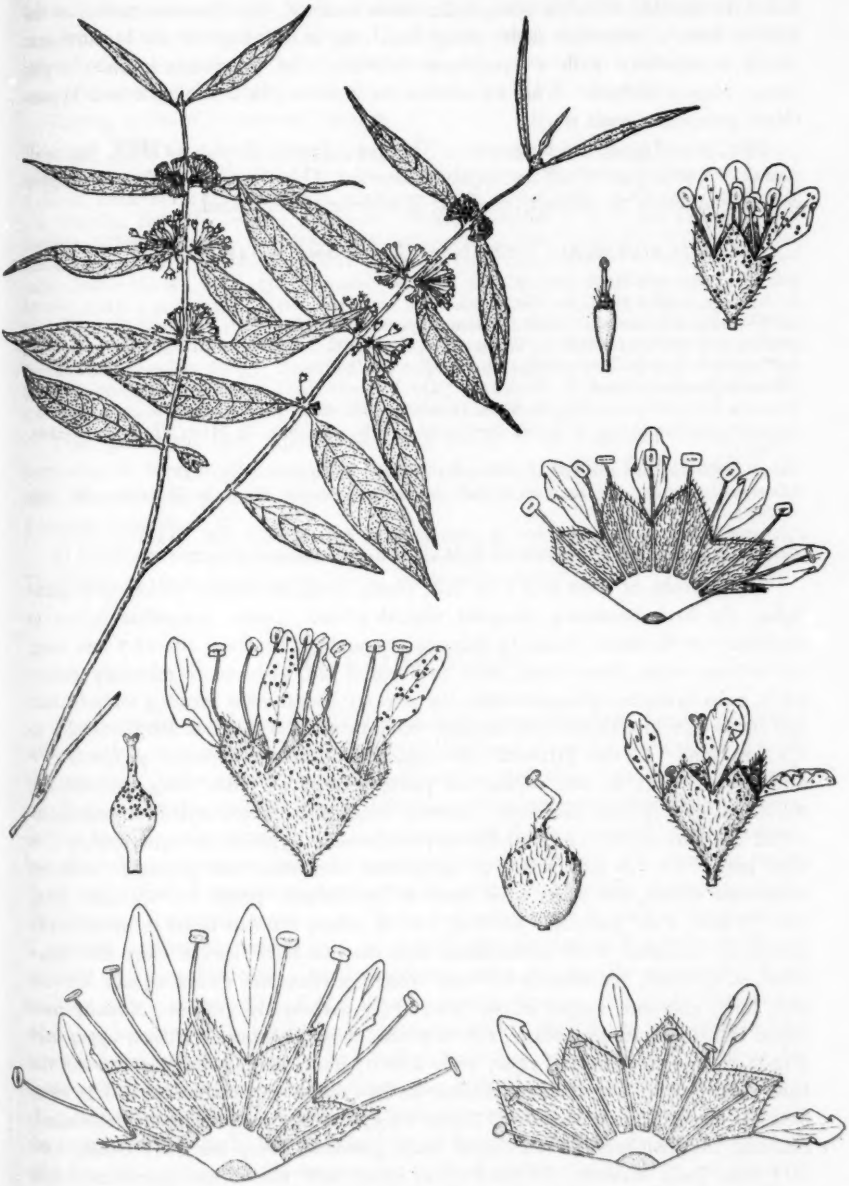

Fig. 35. *Adenaria floribunda*

twice the number of calyx lobes, included or exserted, the filaments united at the base to form a somewhat fleshy perigynous ring at the base of the hypanthium. Ovary bicarpellary with a gynophore, bilocular, the placentation axile; ovules many; stigma bilobed. Fruit an indehiscent ovoid capsule, the style and hypanthium persistent; seeds small.

Mexico to Argentina. Monotypic. The tree *Adenaria floribunda* HBK. has small rose or white flowers which are highly aromatic. This fragrance makes it a highly desirable addition to gardens; hence, it is sometimes cultivated.

1. ADENARIA FLORIBUNDA HBK. Nov. Gen. & Spec. 6:188. 1823.

Adenaria purpurata HBK. loc. cit. 185. 1823.
Adenaria grisleoides HBK. loc. cit. 1823.
Antherylium floribundum (HBK.) Spreng. Syst. 2:475. 1825.
Antherylium grisleoides (HBK.) Spreng. loc. cit. 1825.
Antherylium purpuratum (HBK.) Spreng. loc. cit. 1825.
Adenaria parviflora Hook. Ic. Pl. 2:116. 1837.
Adenaria lanceolata Beurling, in Akad. Handl. Stockh. 124. 1854.
Adenaria floribunda var. α forma *purpurata* (HBK.) Koehne, in Mart. Fl. Bras. 13^2:344. 1877.
Adenaria floribunda var α forma *grisleoides* (HBK.) Koehne, loc. cit. 1877.
Adenaria purpurata var. *australis* Griseb. in Lorentz, Veget. Nordeste Entrerios 116, 135. 1878.
Adenaria floribunda var. *parviflora* Koehne, in Engl. Bot. Jahrb. 4:406. 1883.
Adenaria floribunda var. *microphylla* Koehne, in Engl. Pflanzenr. 4:247. 1903.

Erect shrubs or trees to 2.5 m. tall, young branches shortly villous and glandular, the bark becoming shredded whitish-silver. Leaves lanceolate, acute to acuminate at the apex, obtuse to obtusely attenuate at the base, 2.0–13.5 cm. long, 0.6–5.0 cm. wide, above dark green to purplish red, glabrous to minutely puberulent, paler beneath, villous on veins, the primary lateral veins forming an indistinct and sometimes interrupted submarginal vein; petiole 0.5–5.0 cm. long; stipules to 1.5 mm. long. Cymes gathered into axillary umbelliform clusters; peduncle 1–7 mm. long; bracts in two superposed pairs; pedicel 5–7 mm. long, occasionally subtended by a minute bracteole. Flowers trimorphic: short-styled, intermediate-styled and long-styled. Intermediate-styled flowers: hypanthium campanulate 2–4 mm. long, 3.25–4.0 mm. broad at the orifice, tomentose and glandular without, tomentose within, the calyx lobes more or less deltoid; petals 3.5–4.0 mm. long, 1.0–1.5 mm. wide, glandular without, rose or white; stamens equal or occasionally alternately unequal with antesepalous stamens one-third longer than the antepetalous, exserted, the anthers 0.5 mm. long, the filaments (when equal) 4.5–5.5 mm. long, glabrous, united at the base; ovary turbinately globose gradually narrowed into a cuneate gynophore, 1.75–2.0 mm. long, glabrous or villous, upper half glandular, the placentation axile; style 1.0–1.5 mm. long, glandular toward the base. Short-styled like the intermediate-styled except: hypanthium 2.0–3.25 mm. broad at the orifice; petals 2.0–2.75 mm. long, 0.5–1.25 mm. wide; stamens equal, exserted, the filaments 3.0–4.25 mm. long, glabrous; ovary narrowly ovoid, 1.0–1.25 mm. long, diameter 0.25–0.5 mm., upper half villous and glandular; style 0.5–1.0 mm. long. Long-styled flowers like the intermediate-styled except: petals

2.5 mm. long, 1.0–1.5 mm. wide; stamens equal, included, the filaments 1.5–2.5 mm. long; ovary turbinately globose, 1.5–2.5 mm. long, diameter 1–2 mm., upper half villous and glandular, the gynophore reduced; style 1.5–2.0 mm. long. Fruit an indehiscent ovoid capsule; seeds about 1 mm. long, 0.5 mm. wide.

Known as *fruta de pavo* in Panama.

CANAL ZONE: vicinity of Miraflores Lake, *White & White 187*; mouth of Cocoli River, *P. White 103*; Chagres, *Fendler 313*; Bohio, *Christopherson 138*; Colón to Empire, Panama Railroad, *Crawford 455*; near Gatún, *Goldman 1874*; at the town of Gatún, *Hayes 143, s.n.*; Frijoles, *Bro. Heriberto 17*; between Chagres Batteries & Fort San Lorenzo, Fort Sherman Military Reservation, *Maxon & Valentine 6995*; Old Experiment Station, 3 miles east of Panama City, *Maxon, Harvey & Valentine 7080, 7094*; Empire to Mandinga, *Piper 5487*; Pedro Miguel, *Piper 5513*; around Gamboa, alt. 20–100 m., *Pittier 3412*; Gatún, *Stevens 1345*; Las Cascadas Plantation, near Summit, *Standley 25806, 29602*; vicinity of Fort Sherman, *Standley 30935*; Darién Station, *Standley 31544*; Gamboa, *Standley 28510*; hills west of the Canal, near Gatún, *Standley 27242*; near Fort Randolph, *Standley 28677*; Ancón Hill, *Standley 25155*; Barro Colorado Island, *Kenoyer 462, Bailey & Bailey 265*; Barro Colorado Island, Miller Trail, *Shattuck 481*. PANAMÁ: between Matías Hernández and Juan Díaz, *Standley 31970*; roadside near Chepo, *Dodge 10720*.

This species has been reported as being rarely 3- or 6-merous. This is not surprising in view of the variation between 4- and 5-merous flowers within the same cluster. The panamanian material examined does not demonstrate the 3- or 6-merous condition.

Unusual stamen number is often found, that is, one more stamen than usual. This is due to chorisis, generally in the antesepalous whorl.

LECYTHIDACEAE

Trees, usually massive and tall. Leaves alternate, exstipulate, simple, pinnately veined, entire or somewhat incised, usually large and clustered toward the tips of the branches. Inflorescence variously racemose or paniculate, usually few-flowered, terminal or lateral, occasionally cauliflorous. Flowers perigynous to epigynous, perfect, regular or zygomorphic, usually large and showy; perianth dichlamydeous but the calyx frequently reduced to inconspicuous teeth or a low rim, the petals 4–12, rather fleshy; stamens numerous and in several centripetally decreasing series, the filaments frequently more or less fleshy and petalaceous, united at the base into a common androphore which may be radially symmetrical and wholly fertile or strongly zygomorphic with a very prominent posterior, usually staminodial hood involute over the low disc of the anterior fertile stamens, the anthers basifixed, dehiscing longitudinally or rarely by terminal pores; pistil 2- to 6-carpellate, the ovary inferior or subinferior, 2- to 6-celled, with 2 to numerous anatropous ovules borne apically, laterally, or basally upon the axile placenta, the style usually very short, the stigma radiate to capitate. Fruit very rarely a large 1-seeded berry with thin subcoriaceous flesh, but usually a large woody or fibrous pyx, indehiscent or dehiscent by a circumscissile operculum; seeds characteristically large and massive, rarely compressed and samaroid, sometimes accompanied by a more or less arillate

funicle and fetid pulp derived from the placenta and endocarp, exalbuminous, the embryo differentiated or undifferentiated.

The Lecythidaceae (*sensu stricto*) are wholly American in distribution and are particularly abundant in the Amazonian rain forest or *hylaea*, extending northward in sharply decreasing numbers as far as British Honduras. Fifteen genera are recognized by Knuth in his treatment of the family for Engler's 'Das Pflanzenreich (4^{219a}:1–146. 1939).' The trees include some of the tallest and most massive of the forest and consequently are poorly collected. In Panama they occur mostly as incidental specimens rather than in aggregated stands or groves.

Although the flowers are most attractive and curious, the thick-walled fruits are even more striking, particularly those of *Lecythis*, *Eschweilera*, and *Couratari*, which resemble nothing so much as crude earthenware pots. The characteristically large hard-shelled seeds represent the family the world over in the Brazil-nut of commerce (*Bertholletia excelsa* HBK.).

As with several other intricate families of plants, the name of Lecythidaceae is inseparably associated with that of John Miers, who as an English mining engineer spent eighteen of his early years in Chile, Argentina and Brazil. During his residence in South America, quite without the benefit of special training in the subject, without libraries or herbaria, botany became for Miers an avocation quite as absorbing and exacting as his profession of mineralogy and metallurgy, and he proceeded to accumulate an incredible mass of original notes and sketches of various critical plant families to the elaboration and publication of which he devoted the remainder of his life in England until his death in 1879 at the age of ninety-one years.

Thirty-six years after his return to Britain and at the age of eighty-five, Miers published his memoir 'On the Lecythidaceae' (in Trans. Linn. Soc. 30^2:157–318. 1874) which is the embodiment of his voluminous personal information discovered in the field in South America and supplemented by subsequent studies in the libraries and museums of Europe. Whatever criticism may be directed against the occasional unreality of his taxonomic concepts, the fact remains that little has been added to our biological knowledge of the family in intervening years.

The recent treatment of Knuth, to which reference already has been made, is an improvement over that of Miers in that it includes analytical keys and the citation of considerably more numerous specimens, as might be expected. It is a compilation without much original insight, nevertheless, and depends in the final analysis upon the first-hand knowledge of Miers. The keys, too, present a constant problem since they are divided into geographic couplets for the most part and because of the unfortunate fact that most species are represented by only one or a very few herbarium sheets either in flower or in fruit but seldom both. The possibility of replicate species therefore is great. Of chief aid in the study of the species of Panama is the short study by Pittier (in Contr. U. S. Nat. Herb. 26:1–14. 1927) on the Lecythidaceae of Central America which has the advantages as well, perhaps, as some of the disadvantages of extensive field study.

a. Androphore radially symmetrical, wholly fertile.
  b. Flowers large and showy; petals 6–12; anthers dehiscing by apical pores; Fruit a mediocre pyx containing few to several seeds, dehiscing through deliquescence or irregular shredding of the operculum..... 1. GUSTAVIA
  bb. Flowers small or mediocre; petals 4; anthers dehiscing longitudinally; fruit a mediocre coriaceous or fleshy indehiscent berry usually containing a large solitary seed..... 2. GRIAS
aa. Androphore strongly bilaterally symmetrical, produced into a prominently involute, usually staminodial posterior hood.
  b. Stamens of the hood wholly fertile; ovary 6-celled; fruit a large globose coriaceous indehiscent berry, the seeds several, lateral, ovoid, immersed in fetid pulp..... 3. COUROUPITA
  bb. Stamens of the hood sterile at least in part.
    c. Hood simply involute, wholly staminodial, or the lower stamens sometimes fertile; ovary 4-celled; fruit a large woody subglobose dehiscent pyx, the seeds several, pendulous, thick and angular, with greatly enlarged fleshy funicles..... 4. LECYTHIS
    cc. Hood spirally involute, wholly staminodial; ovary 2-celled; fruit a mediocre woody or subcoriaceous depressed-campanulate dehiscent pyx, the seeds several, basal, sessile, thick and angular..... 5. ESCHWEILERA
    ccc. Hood spirally involute then reversely revolute, wholly staminodial; ovary 3-celled; fruit a mediocre coriaceous narrowly campanulate dehiscent pyx, the seeds several, basal, very thin and broadly winged. 6. COURATARI

1. GUSTAVIA L.

GUSTAVIA L. Pl. Surinam. 18. 1775, nom. conserv.

Japarandiba Adans. Fam. 2:448. 1763, nom. rejic.
Pirigara Aubl. Hist. Pl. Guian. 1:487. 1775, pro parte.
Teichmeyeria Scop. Introd. 267. 1777.
Spallanzania Neck. Elem. 2:79. 1790.

Trees, frequently of gigantic size, rarely shrubby, the leafy twigs ordinarily stout. Leaves usually crowded toward the tips of the twigs, petiolate to sessile, usually conspicuously serrate and large, occasionally rather small for the family and entire or subentire. Flowers usually lateral and cauliflorous, occasionally terminal or subterminal. Hypanthium broadly urceolate, smooth or indefinitely, rarely conspicuously, winged or ribbed. Calyx manifest or reduced to a more or less obscurely 4- to 6-lobed ring. Petals 6–12, rather unequal, large and showy. Androphore radially symmetrical, wholly fertile, the elongate inflexed fleshy filaments of the innumerable stamens coherent at the base into a shallow perigynous ring adnate to the base of the corolla; anthers narrowly cylindrical, dehiscent by 2 apical pores. Ovary 4- to 8-celled, containing numerous lateral anatropous ovules on a stout axile placenta; style conic, the stigma 4- to 8-radiate. Fruit a mediocre pyx containing few to several seeds, dehiscing through deliquescence or irregular shredding of the operculum. Embryo differentiated, with fleshy cotyledons and minute hypocotyl and plumule.

About 40 to 50 species from Costa Rica to Peru and Brazil; one or two species in the Lesser Antilles.

a. Calyx lobes clearly differentiated, 6- to 7-cleft to the hypanthium, foliaceous, accrescent and persistent in fruit; fruit relatively small, longitudinally ribbed or winged, probably dry and dehiscent through shredding of the operculum.

b. Flowers supported by a slender 2-bracteolate pedicel, conspicuously ferruginous-tomentellous, the petals 1.5–2.0 cm. long; pyx turbinate, nearly twice as broad as long, densely ferruginous-tomentellous; leaves essentially entire..... 1. G. PLEUROCARPA

bb. Flowers without a proper pedicel, the hypanthium immediately subtended by 2 small bracteoles, indefinitely ferruginous-papillate, the petals 4.0–4.5 cm. long; pyx cylindric-campanulate, about as long as broad, glabrous or essentially so; leaves rather obscurely undulate-serrate..... 2. G. BRACHYCARPA

aa. Calyx reduced to a more or less obscurely 4- to 6-lobed ring, obscure and not accrescent in fruit; fruit relatively large, not clearly ribbed or winged, probably more or less pulpy and dehiscent through deliquescence of the operculum.

b. Leaves mediocre, up to about 4 cm. long, with proportionally long petioles, oblong-lanceolate; flowers about 6 cm. in diameter; pyx not very fleshy, the pericarp about 5 mm. thick, the operculum large, as broad as the body of the fruit..... 3. G. NANA

bb. Leaves large, up to about 10 dm. long, with proportionally short petioles, elliptic-oblanceolate; flowers 10–15 cm. in diameter; pyx very fleshy, the pericarp about 5–10 mm. thick, the operculum small, about one third as broad as the body of the fruit..... 4. G. SUPERBA

In the strict sense, Linnaeus' *Gustavia* would embrace only the last two species of the key and Aublet's *Pirigara* the first two. It is indeed a great temptation to separate the two groups generically, but it is resisted here for the very cogent fact that we must qualify the description of the fruits by the adverb "probably." Aublet himself, however, describes the fruit of *Pirigara hexapetala* (= *Gustavia hexapetala* (Aubl.) Sm.), which would coincide with the former group, as "sèche", while Miers (loc. cit. p. 159) reports that in *Gustavia*, supposedly of the latter group, "on the ripening of the fruit, the dissepiments and placentae become resolved into a pulp, which envelopes the seeds, all escaping together *with the decay of the operculum* [italics ours]."

Whether the fruits differ or no, it is clear that such recent authors as Eyma (in Fl. Surinam. 3^1:121. 1934) and Pittier (loc. cit. 2. 1927) err in characterising the fruits as indehiscent without any qualification. It is impossible to understand why Pittier, particularly, could actually key *Gustavia* upon such a statement immediately before describing *G. pleurocarpa* Pitt. and *G. brachycarpa* Pitt., the type collections of which, gathered by Pittier himself, include abundant dry, empty pyxes with perfectly round opercular openings. I have also seen similar fruits with very definite opercular openings upon specimens of *G. hexapetala*, as has my friend Noel Y. Sandwith, of Kew, for *G. laciniosa*.

Insofar as floral characters distinguishing *Pirigara* and *Gustavia* are concerned, other than the natures of the calyx, I have been able to observe only that the anthers of *Gustavia* are proportionally more elongate and deeply sulcate than those of *Pirigara*. The flowers themselves of *Gustavia*, however, are most usually densely cauliflorous while those of *Pirigara* are more in smaller terminal or subterminal clusters. In short, the problem appears insoluble upon our present evidence, and is commended to the attention of future collectors in the field.

1. GUSTAVIA PLEUROCARPA Pittier, in Contrib. U. S. Nat. Herb. 26:4. 1927.

Trees up to 20 m. tall, with stout straight trunks; leafy twigs slender. Leaves

rather distant, distinctly petiolate, the blade elliptic to elliptic-obovate, rather abruptly acuminate, obtusely cuneate and somewhat decurrent to the petiole, 8–20 cm. long, 4–8 cm. broad, glabrous, firmly membranaceous, essentially entire; petiole 1.5–2.0 cm. long. Flowers terminal or subterminal, solitary or paired; peduncle about 2 cm. long, rather stout, 2-bracteate at about the middle, densely ferruginous-tomentellous; hypanthium broadly turbinate, about 7 mm. high and 10 mm. wide, densely ferruginous-tomentellous, longitudinally winged alternate with the calyx lobes; calyx lobes 6, broadly triangular, acute, about 8 mm. long, thickly foliaceous, densely ferruginous-tomentellous; petals 6, yellowish white, broadly ovate, nearly equal, 2.5–3.0 cm. long, densely ferruginous-tomentellous without and within minutely so. Somewhat immature fruits turbinate, about 8 mm. high and 18 mm. in diameter, crowned by the somewhat accrescent persistent calyx lobes, densely ferruginous-tomentellous without, not very prominently winged.

Lowland forests of the Atlantic watershed, Panama, Colombia.

COLÓN: Loma de la Gloria, near Fató (Nombre de Dios), *Pittier 3857, 4104, 4426.*

I doubt very much that this species actually is distinct from *G. hexapetala*, but I do not feel competent to make the reduction.

Fig. 36. *Gustavia brachycarpa*

2. GUSTAVIA BRACHYCARPA Pittier, in Contrib. U. S. Nat. Herb. 26:3. 1927.

Trees 5–15 m. tall, with stout straight trunks; leafy twigs slender. Leaves rather distant, distinctly petiolate, the blade obovate-elliptic, rather abruptly and narrowly acuminate, obtusely cuneate and somewhat decurrent to the petiole, 9–22 cm. long, 3–8 cm. broad, glabrous, firmly membranaceous, rather obscurely undulate-serrulate; petiole 1–2 cm. long. Flowers terminal or subterminal, solitary or in pairs; peduncle rather slender, 1–2 cm. long in flower, accrescent and decurrently winged in fruit; hypanthium turbinate, broadly winged, about 5 mm. high

and 8 mm. broad, minutely ferruginous-papillate; calyx lobes 6, broadly triangular, about 12 mm. long, thickly foliaceous, ferruginous-papillate; petals 6, white, broadly oval, nearly equal, 4.0–4.5 cm. long, minutely ferruginous-papillate without and within. Mature fruits cylindric-campanulate, about 3 cm. long and 2 cm. broad, gradually decurrent to the accrescent winged peduncle, crowned by the accrescent persistent calyx lobes, essentially glabrous without.

Lowland forests and swamps of the Pacific watershed, Panama.

CHIRIQUÍ: vicinity of San Félix, *Pittier 5269*; west of Remedios, *Allen 787*.

The beautiful and informative fruits of *Pittier 5269* have been discussed above. *Allen 787* is in flower. This must correspond to Seemann's (Bot. Voy. H.M.S. Herald 126. 1853) record of *Lecythis coriacea* DC. from Remedios, which he calls *ollito* (little pot-tree), doubtless with reference to the dry dehiscent fruits. With great significance from the standpoint of our argument Seemann reports the vernacular name of the true Gustavias as *membrillo* (quince tree), which is in wide use in Panama to the present day.

3. GUSTAVIA NANA Pittier, in Contrib. U. S. Nat. Herb. 26:5. *pl. 3–4.* 1927.

Gustavia rhodantha Standl. in Field Mus. Publ. Bot. 4:239. 1929.

Shrubs or small trees to about 9 m. tall; leafy twigs rather slender. Leaves congested seasonally toward the tips of the branches, of mediocre size for the genus and with proportionately long slender petioles, the blade rather narrowly oblong-lanceolate, up to about 4 dm. long and 8 cm. broad, rather gradually and acutely acuminate, more abruptly cuneate at the base, rather obscurely and distantly undulate-serrulate, membranaceous, glabrous; petiole variable in length, about 3–15 cm. long. Flowers mostly densely cauliflorous beneath the terminal cluster of leaves; peduncle corymbosely several-flowered; hypanthium depressed-turbinate, about 7 mm. broad and 5 mm. long at anthesis; calyx reduced to an obscurely 4-lobed ring 1.5–2.0 cm. in diameter, minutely puberulent-papillate; petals 6–8, more or less unequal, oblong-obovate, deep pink, 2.5–3.5 cm. long, densely papillate. Mature fruits subglobose, up to about 7 cm. in diameter, the opercular region of about equal diameter, not very fleshy, the pericarp about 5 mm. thick.

Apparently endemic to Panama, in lowland forests.

COLÓN: Loma de la Gloria, near Fató (Nombre de Dios), *Pittier 4093*. DARIÉN: near mouth of Río Yapé, *Allen 349*; Marragantí and vicinity, *Williams 655*. SAN BLAS: Permé, *Cooper 239*.

4. GUSTAVIA SUPERBA (HBK.) Berg, in Linnaea 27:444. 1856.

Pirigara superba HBK. Nov. Gen. & Spec. 7:261. 1825.
Gustavia insignis Linden, ex Hook. Bot. Mag. *pl. 5069.* 1858.
Gustavia superba var. *salviniae* Hemsl. Biol. Centr.-Am. Bot. 1:413. 1880.
Japarandiba superba (HBK.) O. Ktze. Rev. Gen. 240. 1891.

Trees to about 20 m. tall, with stout straight trunks, branching infrequently; leafy twigs rather stout. Leaves congested seasonally toward the tips of the branches, usually very large and with proportionally short and stout petioles, the

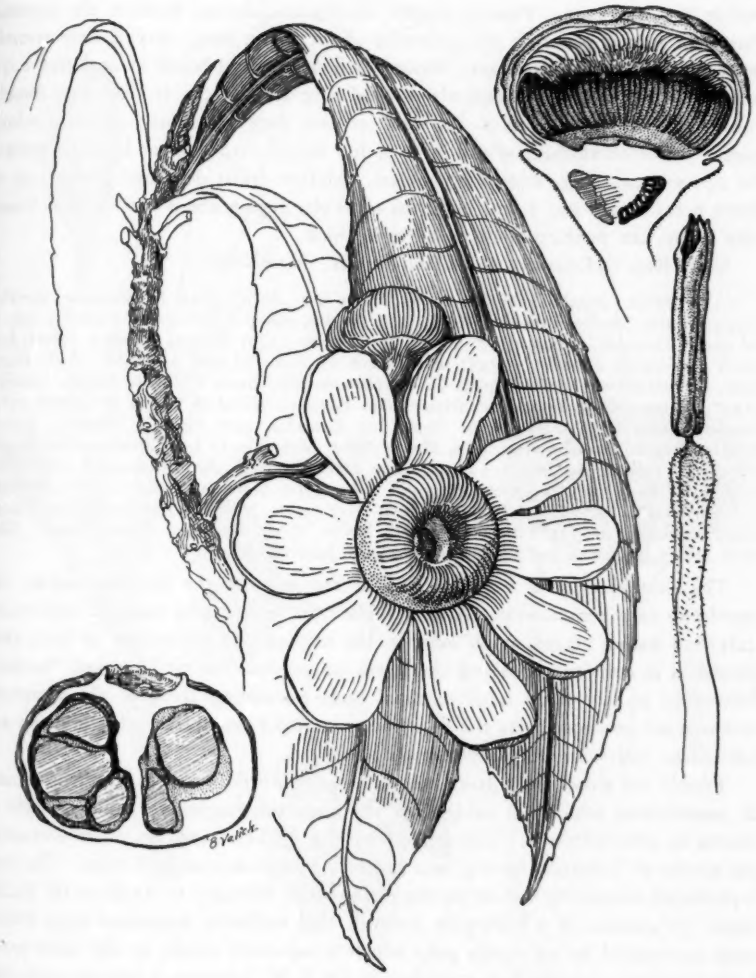

Fig. 37. *Gustavia superba*

blade elliptic-oblanceolate, up to about 10 dm. long and 2 dm. broad, rather abruptly and acutely acuminate, narrowly cuneate and more or less decurrent to the petiole, coarsely to rather obscurely undulate-serrate, membranaceous, glabrous; petiole 2–9 cm. long. Flowers mostly densely cauliflorous beneath the terminal cluster of leaves; peduncle stout, usually about 6 cm. long, corymbosely several-flowered; hypanthium turbinate, about 1.5 cm. long and broad at anthesis; calyx reduced to a more or less obscurely 4-lobed ring 1.5–2.0 cm. in diameter, densely puberulent-papillate; petals 6–12, more or less unequal, oblong-obovate, white, usually yellowish at the base and more or less tinged with pink or lavender toward the tip, 4–7 cm. long, minutely papillate. Mature fruits depressed-globose, up to about 8 cm. broad and 6 cm. long, the opercular region about one third as broad, very fleshy, the pericarp about 5–10 mm. thick.

Costa Rica to Ecuador, in lowland forests. *Membrillo.*

CANAL ZONE: hospital grounds, Ancón, *Mason s. n.*, *Pittier 2746*; Ft. Sherman, *Standley 30955*; Darién Station, *Standley 31553*; Río Paraíso, above East Paraíso, *Standley 29917*; old site of Gorgona, *Maxon 6787*; Gatuncillo, *Stevens 1159*; Obispo, *Standley 31709*; hills north of Frijoles, *Standley 27443*; near mouth of Río Chagres, *Allen 880, 856*; Monte Lirio, *Christopherson 128*; Empire, *Christopherson 197*; Barro Colorado Island, *Standley 31447*; Salamanca Hydrographic Station, Río Pequení, *Woodson, Allen & Seibert 1582*; Gamboa, *Standley 28389, Stevens 1090*; Las Cascadas, near Summit, *Standley 25716, 29591*; Chagres arm of Gatún Lake, *Maxon 6554*; Matachín to Las Cascadas, *Cowell 328*. COCLÉ: El Valle de Antón, alt. 600 m., *Allen 4206*; Bismarck above Penonomé, 2000–3000 ft. elev., *Williams 435*. DARIÉN: Pinogana, *Allen 4310*; Marraganti and vicinity, *Williams 693*. PANAMÁ: Pacora, *Bro. Paul 341*; Juan Díaz region, *Maxon & Harvey 6746a*; Taboga Island, *Standley 27934*; Taboguilla Island, *Miller 1998*; Trapiche, Perlas Islands, *Allen 2610, Miller 1874*; San José Island, *Erlanson 495, Johnston 282.*

The enormous leaves crowded toward the ends of the branches render the *membrillo* very conspicuous. Although the trees do not pass through consecutive leafy and leafless stages, as do some in the tropics, and always are in leaf, their growth is in definite cycles and the leaves are produced in well marked "flushes." Preceeding such a flush, large terminal buds resembling those of the temperate hickories are produced. As the first leaves develop from these buds the nodes and subsequent leaf scars are conspicuously congested.

Freshly cut wood and wilting leaves of the *membrillo* produce an offensive odor of putrifaction which has earned for the trees the suggestive name of *palo de muerte* in some localities. This is apparently a quality shared by other Gustavias, one species of Venezuela having been named *G. fustis-mortui* by Pittier. The fruit is produced toward the end of the dry season from February to April on the Pacific slope. It consists of a brown or greenish rind enclosing numerous large brown seeds surrounded by an orange pulp which is reputedly edible, as the name *membrillo* (quince) suggests, but according to Dr. I. M. Johnston is scarcely palatable.

2. GRIAS L.

GRIAS L. Syst. ed. 10. 1075. 1759.

Pirigara Aubl. Hist. Pl. Guian. 1:487. 1775, pro parte.

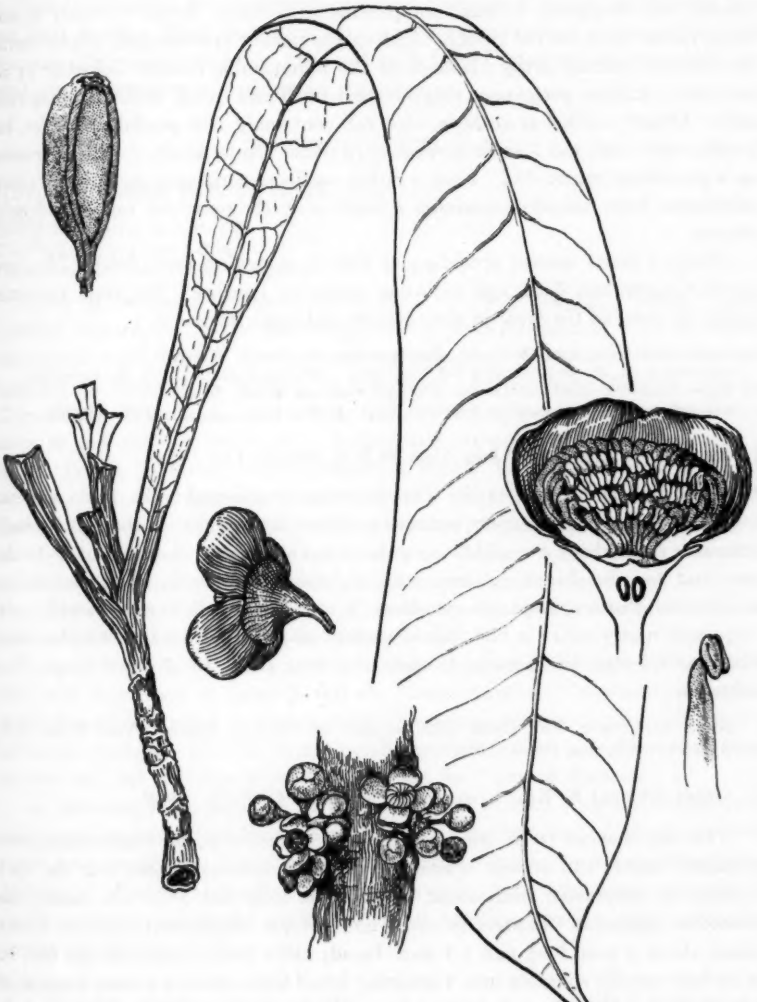

Fig. 38. *Grias pittieri*

Large trees, the leafy twigs stout and fistulose. Leaves usually crowded toward the end of the twigs, ordinarily sessile or subsessile. Flowers few to several in dense umbelliform cauliflorous clusters. Hypanthium urceolate. Calyx nearly entire to broadly and irregularly 4-lobed, not prominent in fruit. Petals 4, rarely 5, subequal, rather small for the family. Androphore radially symmetrical, wholly fertile, the elongate inflexed fleshy filaments of the innumerable stamens coherent at the base into a shallow perigynous ring; anthers small and ovoid, dehiscing longitudinally. Ovary 4-celled at anthesis, each cell containing 2–4 pendulous ovules, but usually only 1 cell and 1 ovule developing in fruit; stigma sessile, 4-radiate, inserted on a prominent square disc. Fruit a rather mediocre coriaceous or fleshy pyriform indehiscent berry usually containing a single seed, the opercular region and calyx obscure.

About a dozen species, according to Knuth, extending from British Honduras to the Guianas and Peru, and with one species in Jamaica. The trees are rather similar to those of *Gustavia* in their stature and large leaves.

a. Leaves very large, about 6–10 dm. long and 2–4 dm. broad; flowers relatively large, the petals about 1.5–2.0 cm. long. Atlantic slope..... 1. G. FENDLERI
aa. Leaves mediocre, about 4.0–4.5 dm. long and 5–16 cm. broad; flowers relatively small, the petals about 8–10 mm. long. Pacific slope..... 2. G. PITTIERI

1. GRIAS FENDLERI Seem. Bot. Voy. H.M.S. Herald 126. 1854.

Trees to about 15 m. tall. Leaves sessile or subsessile, the blade obovate-spatulate, shortly and abruptly acuminate to broadly rounded at the tip, gradually attenuate from above the middle to a decurrent subpetiolar base, about 6–10 dm. long and 2–4 dm. broad, subcoriaceous, glabrous. Flowers in small umbelliform cauliflorous clusters; hypanthium about 3 mm. long and 2 mm. broad; calyx frequently nearly entire in bud, but at anthesis usually splitting into 4 rather broad lobes about 2 mm. long; petals 4, white or cream, about 1.5–2.0 cm. long. Fruit unknown.

BOCAS DEL TORO: Fish Creek hills, vicinity of Chiriquí Lagoon, *Von Wedel 2423*. CANAL ZONE: Chagres, *Fendler* 187.

2. GRIAS PITTIERI R. Knuth, in Engl. Pflanzenr. 4^{219a}:29. 1939.

Trees up to about 10 m. tall. Leaves sessile or subsessile, the blade oblanceolate-spatulate, shortly and acutely acuminate, gradually attenuate from near the tip to a decurrent subpetiolar base, about 4.0–4.5 dm. long and 5–16 cm. broad, subcoriaceous, glabrous. Flowers in small umbelliform cauliflorous clusters; hypanthium about 2 mm. long and 1.5 mm. broad; calyx nearly entire in the bud but at anthesis usually splitting into 4 irregular broad lobes about 1.5 mm. long; petals 4 or rarely 5, white, about 8–10 mm. long. Fruit pyriform, 2–3 cm. long, 2.0–2.5 cm. broad, gradually attenuate to a persistent pedicel of nearly equal length, greenish brown.

Pacific coast of Panama, in lowland forests. Cooper and Slater report the vernacular names *jaguey* and *membrillo*.

CHIRIQUÍ: vicinity of Puerto Armuelles, *Woodson & Schery 901*; Progreso, *Cooper & Slater 228*. DARIÉN: around Pinogana, *Pittier 6552*; trail between Pinogana and Yavisa, *Allen 273*.

It is unfortunate that intermediate stations between Chiriquí and Darién have not been found. While the leaves of the two populations are quite similar, both specimens from Chiriquí are in fruit and both from Darién are in flower only, and their correlation thus is in doubt to that degree.

3. COUROUPITA Aubl.

COUROUPITA Aubl. Hist. Pl. Guian. 708. 1775.

Pontopidiana Scop. Introd. 195. 1777.
Elsholtzia Neck. Elem. 2:256. 1790.
Pekea Juss. Gen. 249. 1798, pro parte.

Trees of moderate to gigantic size, the leafy twigs ordinarily stout. Leaves crowded toward the tips of the twigs, shortly petiolate, broadly obovate-cuneate and rather small for the family, entire to serrulate. Flowers in extensive subterminal to cauliflorous racemes and panicles. Hypanthium broadly obovoid. Calyx deeply 6-lobed, inconspicuous in fruit. Petals 6, more or less unequal, white more or less suffused with red. Androphore strongly bilaterally symmetrical, wholly fertile, produced into a prominent simply involute posterior hood, the stamens of the hood somewhat larger and with longer filaments than those of the central disc; anthers very small and ovoid, dehiscing longitudinally. Ovary 6-celled, containing numerous lateral anatropous ovules; stigma sessile, 6-radiate, inserted on a prominent round disc. Fruit a large globose indehiscent coriaceous berry, the seeds several, compressed, of moderate size, immersed in fetid pulp, the embryo differentiated and with fleshy cotyledons.

About 19 species according to Knuth, extending from Nicaragua to Amazonian Peru and Brazil and in Jamaica and the Lesser Antilles. *Couroupita guianensis* Aubl., known in English as Cannon-ball Tree, is occasionally cultivated in tropical parks and gardens. The handsome, usually reddish flowers vary from 3 to 9 cm. in diameter, and the large globular fruits may be 2 dm. in diameter.

In prefacing his account of the Couroupitas of Central America Pittier wrote, "Owing to the scarcity of the cannon-ball trees, it has been found difficult to obtain satisfactory specimens. For this reason the three following species are incompletely described." Knuth, although presenting detailed descriptions, generates even less confidence by his key to the species of Central America, which is reproduced below for the possible use of the reader:

B. Species centrali-americanae.
  a. Nicaragua; Costarica: flos ad 7 cm diam. ..... 15. *C. nicaraguensis*
  b. Panama.
    α. Flos 8–9 cm diam. ..... 16. *C. Cutteri*
    β. Flos 7–8 cm diam. ..... 17. *C. darienensis*
    γ. Flos 4–5 cm diam. ..... 18. *C. odoratissima*
    δ. Flos 3 cm diam. ..... 19. *C. parviflora*

In his key to the three Central American species recognized by him, Pittier

Fig. 39. *Couroupita guianensis*

distinguishes *C. odoratissima* Seem. as a "low spreading savanna tree, branched almost from the base" and *C. nicaraguensis* DC. and *C. darienensis* Pittier as "high forest trees"; yet Seemann assigns a height of 60–80 feet to the type trees of *C. odoratissima*. *Couroupita cutteri* Morton & Skutch and *C. parviflora* Standl. both are reported only through single collections in the immediate vicinity of the Chiriquí Lagoon.

Since a total of only three herbarium specimens is available for our study at present, it appears quite impossible to treat the species in the usual way since the leaves are nearly, if not quite, identical and the dimensions of the flowers analysed by Knuth present a continuum (the flowers of the type specimen of *C. parviflora* obviously are not fully expanded). The three specimens examined for the present account are as follows:

BOCAS DEL TORO: 15 mi. from Almirante, *Skutch 19* (type of *C. cutteri* in U. S. Nat. Herb.); Changuinola valley, *Cooper & Slater 11* (type of *C. parviflora* in U. S. Nat. Herb.). DARIÉN: forests around Pinogana, *Pittier 6563* (type of *C. darienensis* in U. S. Nat. Herb.).

The type specimen of *C. odoratissima* was collected by Seemann in the forests of Río de Jesús, between Santiago and Puerto Mutis, Veraguas. According to Pittier, the species since has been seen by Dr. Otto Lutz in forests of Hato de San Juan, between San Lorenzo and San Félix, eastern Chiriquí, but the photograph to which he refers is not included in the U. S. National Herbarium.

An adequate herbarium representation of *Couroupita* is one of the outstanding desiderata for a complete Flora of Panama. Seemann was informed by local residents that *C. odoratissima* was to be found only in a small area at the type locality. Failure of recent collectors to find more ample material suggests that the species, one or several, must be extremely local and infrequent.

5. LECYTHIS Loefl.

LECYTHIS Loefl. It. Hisp. 189. 1758.

Bergena Adans. Fam. 2:345. 1763, nec Neck. nec Raf.

Large trees. Leaves large and coriaceous, or unusually small for the family, entire to crenulate, usually not congested at the tips of the twigs. Flowers in subterminal or axillary panicles. Hypanthium obovoid. Calyx deeply 6-lobed, becoming a more or less prominently thickened and approximately median rim in fruit. Petals 6, unequal. Androphore strongly bilaterally symmetrical, produced into a prominent posterior simply involute wholly or partially staminodial hood concealing the low staminiferous central disc; anthers ovoid, dehiscing longitudinally. Ovary 4-celled, with several pendulous anatropous ovules; stigma sessile, 4-radiate. Fruit a large woody subglobose dehiscent pyx, the seeds several, large and angulate, pendulous from the greatly enlarged fleshy funicles, the embryo undifferentiated.

About 50 species, according to Knuth, extending from Costa Rica to southern Brazil, and in the Lesser Antilles. The trees are amongst the largest of the tropical

American forests, and the hard wood is used structurally. The large fruits resemble aboriginal pottery, hence the Spanish vernacular *olla de mono* and the English Monkey-pot. The trees and their timber are known as *cocobolo* in Panama and Costa Rica.

Pittier (in Contrib. U. S. Nat. Herb. 26:8. 1927) recognized four species of *Lecythis* in Panama, basing them chiefly upon rather obscure differences seen in the fruits. In an earlier paper on the Lecythidaceae of Costa Rica (loc. cit. 12:95–101. 1908), however, he included a photograph of several fruits of *L. costaricensis* which displays striking variance and casts considerable doubt upon the reality of his subsequent species. Only two species are recognized here.

a. Leaves large and coriaceous, about 20–50 cm. long, entire or essentially so; pyx with the margin of the orifice convex, rough and irregularly muricate with the bases of the abscissed veins, the calycine rim indefinitely erose or subentire. Pacific slope..... 1. L. TUYRANA

aa. Leaves small and membranaceous, about 8–10 cm. long, finely crenulate; pyx with the margin of the orifice concave, relatively smooth and with little evidence of abscissed veins, the calycine rim conspicuously 6-lobed. Atlantic slope..... 2. L. AMPLA

1. LECYTHIS TUYRANA Pittier, in Contrib. U. S. Nat. Herb. 26:9. *pl. 7.* 1927.

Lecythis melliana Pittier, loc. cit. 8. *pl. 6.* 1927.

Large trees to about 30 m. tall, the leafy twigs stout and thinly rimose. Leaves large and coriaceous, broadly oblong to oval, abruptly and shortly acuminate, rounded and inconspicuously decurrent at the base, about 20–60 cm. long and 6–20 cm. broad, entire, glabrous; petiole stout and canaliculate, 1–2 cm. long. Inflorescence paniculate, many-flowered, the stout puberulent peduncle about as long as the subtending leaves. Flowers sessile; calyx lobes broadly ovate to reniform, obtuse or rounded, 6–8 mm. long; petals oval, 2.5–3.0 cm. long, yellow. Fruit subglobose, deep brown and roughly verrucose, 10–15 cm. long and broad, the calycine rim indefinitely erose to subentire, median or submedian, the margin of the orifice convex, rough and irregularly muricate with the bases of the abscissed veins.

Pacific slope of eastern Panama, in lowland forests; sometimes planted for ornament in the Canal Zone.

CANAL ZONE: near firehouse, Balboa, *Standley 26898*; Balboa, *Standley 30867*, *Johansen 32*. DARIÉN: Pinogana, *Pittier 6576*, *6538*.

2. LECYTHIS AMPLA Miers, in Trans. Linn. Soc. 30:204. *pl. 43, figs 1–2.* 1874.

Lecythis armilensis Pittier, in Contrib, U. S. Nat. Herb. 26:9. *pl. 8.* 1927.

Large trees to about 40 m. tall, the leafy twigs remarkably slender. Leaves relatively small and membranaceous, broadly elliptic, abruptly and rather shortly subcaudate-acuminate, obtuse at the base, about 8–10 cm. long, finely crenulate, glabrous; petiole slender, about 5 mm. long. Flowers unknown to us. Fruit globose-subampullaceous, yellowish brown and finely granular, not verrucose, 15–20 cm. long, 12–15 cm. broad, the calycine rim at the upper third and distinctly 6-lobed, the margin of the orifice concave, relatively smooth and with little evidence of the abscissed veins.

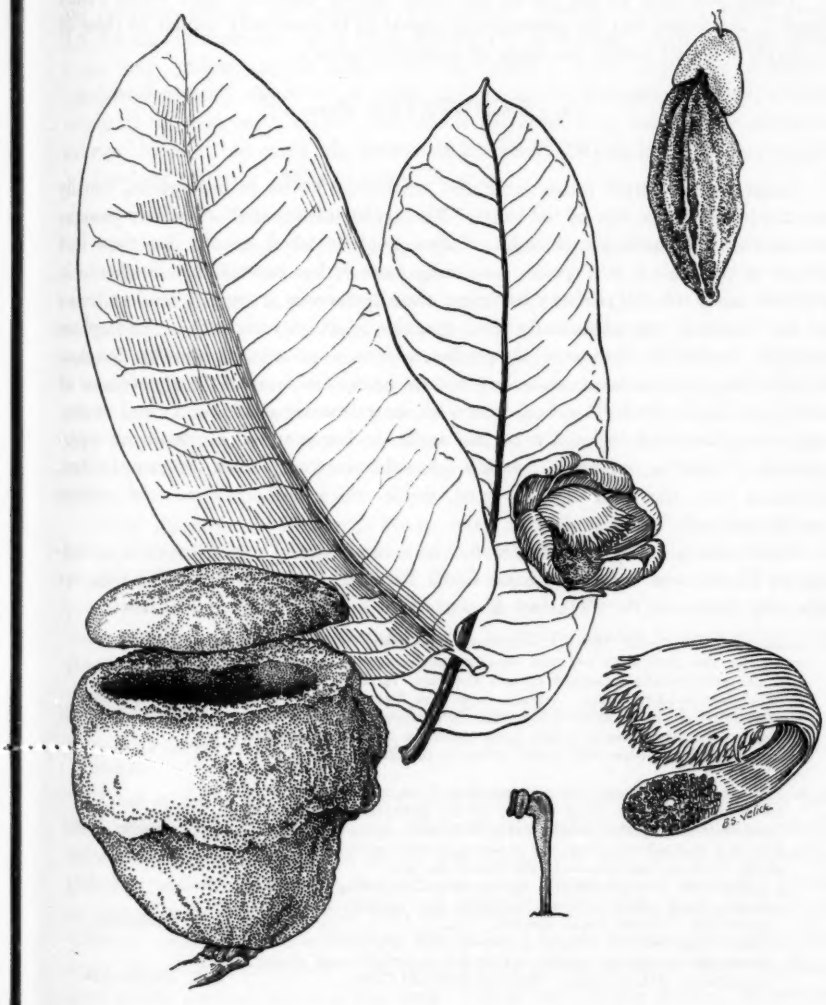

Fig. 40. *Lecythis tuyrana*

Atlantic lowlands of Panama; Colombia.

SAN BLAS: hills of Sperdi, near Puerto Obaldía, *Pittier 4343*.

I have not seen the old fruits, also from Puerto Obaldía, upon which Pittier based *L. armilensis*, but the photographs appear to be essentially similar to those of *L. ampla* and well within the range of expected variance.

6. ESCHWEILERA Mart.

ESCHWEILERA Mart. ex DC. Prodr. 3:293. 1828.

Large trees. Leaves rather large and coriaceous, entire in our species, usually not congested at the tips of the twigs. Flowers in subterminal or axillary panicles or racemes. Hypanthium obovoid. Calyx deeply 6-lobed, usually less than half adnate to the fruit in our species, becoming more or less prominently thickened in fruit or rarely (*E. calyculata*) retaining their coriaceous texture. Petals 6, more or less unequal (of abnormally thin texture in *E. panamensis*). Androphore strongly bilaterally symmetrical, produced into a prominent spirally involute staminodial posterior hood concealing the relatively few minute fertile stamens of the central disc. Ovary 2-celled, each with several nearly sessile erect basal ovules; stigma capitate and essentially entire, sessile or borne upon a prominent stylopodium. Fruit a mediocre, woody or subcoriaceous, depressed-campanulate, dehiscent pyx, the seeds several, basal, sessile, thick and angulate, the embryo undifferentiated.

This is the largest genus of Lecythidaceae, consisting of over 90 species according to Knuth, and extending from Costa Rica to central Brazil. The trees are generally similar to *Lecythis*, but do not attain such great size in Panama.

a. Flowers relatively small, about 1.5–2.0 cm. in diameter, the petals thin in texture, the calyx lobes 1–2 mm. long; peduncles slender and paniculate, characteristically branched toward the base; leaves rather small, usually about 6–12 cm. long. Atlantic slope: San Blas..... 1. E. PANAMENSIS

aa. Flowers relatively large, about 2.5–3.5 cm. in diameter, the petals thick in texture, the calyx lobes 6–9 mm. long; peduncles thick and racemose, characteristically unbranched; leaves rather large, usually about 15–35 cm. long.

b. Pyx very thickly woody, the pericarp about 1 cm. thick or more, the calyx lobes adnate to about midway of the pyx and becoming very prominent and woody. Pacific slope: Chiriquí..... 2. E. PITTIERI

bb. Pyx thin and subcoriaceous, the pericarp scarcely more than 2 mm. thick, the calyx lobes adnate to the base of the pyx.

c. Calyx lobes strongly adnate, not accrescent, becoming vestigial in fruit; leaves elliptic-oblong, narrowly and acutely subcaudate-acuminate. Pacific slope: Darién..... 3. E. GARAGARAE

cc. Calyx lobes weakly adnate, accrescent and prominent in fruit; leaves obovate-oblong, obtuse or rounded to abruptly and obtusely acuminate. Atlantic slope: Bocas del Toro and Colón..... 4. E. CALYCULATA

1. ESCHWEILERA PANAMENSIS Pittier, in Contrib. U. S. Nat. Herb. 26:12. 1927.

Eschweilera reversa Pittier, loc. cit. 11. 1927, pro parte?

Trees up to 25 m. tall, the leafy twigs relatively slender. Leaves shortly petiolate, oval, very abruptly and shortly acuminate or obtuse at the tip, broadly

obtuse or rounded at the base, about 8–12 cm. long, 3–8 cm. broad, coriaceous, glabrous; petiole rather stout, about 5 mm. long. Inflorescence subterminal and axillary, paniculate, many-flowered, somewhat longer than the subtending leaves, the peduncle slender and minutely puberulent. Flowers relatively small, about 1.5–2.0 cm. in diameter; calyx lobes deltoid, 1–2 mm. long; petals unequal, about 1 cm. long, yellow, thin in texture for the family. Fruit (according to Pittier) "globose-depressed, about 4 cm. long and 5 cm. in diameter, 2-celled, slightly attenuate at base, with rather thin walls; calycinal zone bearing the persistent enlarged lobes of the calyx, the interzonal band 1.5–2.0 cm. broad."

Lowland forests of Atlantic slope, Panama.

SAN BLAS: hills back of Puerto Obaldía, *Pittier 4338*.

The fruit accompanying the type specimen apparently has been lost or misplaced in the U. S. National Herbarium.

The type sheet of *E. reversa* (*Pittier 4394* in U. S. Nat. Herb.) from the Plain of Sperdí, near Puerto Obaldía, seems to be a mixture consisting of a leafy branch, possibly a *Rinorea*, and a detached pyx and operculum of an *Eschweilera*. Although it would be odd for such a veteran as Pittier to mis-associate two such unrelated plants and although I cannot be positive of the species of the leaves, I feel certain that the leaves are not from an *Eschweilera*, particularly because of their prominent linear stipules. The fruit resembles those of *E. pittieri*, of the Pacific slope of Chiriquí, very closely.

In his discussion of *E. reversa* Pittier states that the pyx and the operculum of his type sheet of the species were found detached under trees, presumably from which his leafy branch was obtained, "but since there were trees of *Eschweilera panamensis* scattered in the forest all around, the source of that lid is not absolutely certain." Under such circumstances, *E. reversa* cannot be regarded as more than a *nomen dubium* at the present time.

2. ESCHWEILERA PITTIERI R. Knuth, in Engl. Pflanzenr. 4^{219a}:93. 1939.

Eschweilera verruculosa Pittier, in Contrib. U. S. Nat. Herb. 26:13. *pl. 12*. 1927, non Miers.

Trees up to 20 m. tall, the leafy twigs relatively slender. Leaves shortly petiolate, elliptic-oblong, abruptly and rather shortly and acutely acuminate, broadly obtuse or rounded at the base, 12–30 cm. long, 6–12 cm. broad, subcoriaceous, glabrous; petiole rather stout, 1.0–1.5 cm. long. Inflorescence racemose, several- to many-flowered, much shorter than the subtending leaves, the peduncle stout and glabrous. Flowers relatively large, about 3.0–3.5 cm. in diameter; calyx lobes ovate, obtuse, approximately 1 cm. long; petals yellow or white, obovate-oblong, more or less unequal, about 2 cm. long. Fruits very thickly woody, the pericarp about 1 cm. thick or more, conspicuously brown-verruculose, particularly in the calycine zone, depressed-globose, about 2.5–5.0 cm. long and 3.5–6.0 cm. broad, the calyx lobes adnate to about midway of the pyx and becoming very prominently woody, the operculum conspicuously domed and nearly hemispheric, almost half as deep as the body of the pyx.

Fig. 41. *Eschweilera pittieri*

Lowland forests, Pacific slope of Panama.

CHIRIQUÍ: vicinity of San Félix, *Pittier 5290, 5738*; Río Tinta, along main highway, *Woodson, Seibert & Allen 402*; San Félix to Cerro Flor, *Allen 1920*; vicinity of Remedios, *Allen 3476*.

3. ESCHWEILERA GARAGARAE Pittier, in Contrib. U. S. Nat. Herb. 12:12. 1927.

Trees up to about 35 m. tall, the leafy twigs relatively slender. Leaves elliptic-oblong, narrowly and acutely subcaudate-acuminate, broadly rounded or obtuse at the base, about 12–35 cm. long and 3–12 cm. broad, membranaceous to subcoriaceous, glabrous; petiole about 1.0–1.5 cm. long. Inflorescence racemose, several-flowered, the peduncle rather stout and inconspicuously puberulent, much shorter than the subtending leaves. Flowers relatively large, about 3.0–3.5 cm. in diameter; calyx lobes broadly ovate, acute, about 6–9 mm. long; petals yellow, somewhat unequal, broadly oval, about 2 cm. long. Fruits depressed-globose, about 5 cm. long and 5.5–6.0 cm. broad, the pericarp rather thin and subcoriaceous, scarcely more than 2 mm. thick, the calyx lobes strongly adnate to the very base of the pyx, not accrescent, becoming obscure and vestigial, the operculum rather flat and not conspicuously constricted at the orifice, about one third as deep as the body of the pyx.

Lowland forests of the southeastern Pacific slope of Panama.

DARIÉN: foothills of Garagará, Sambú basin, *Pittier 5616*; vicinity of Pinogana, *Allen 920*; Marragantí on the Tuyra R., about El Real, *Pittier 6596*.

4. ESCHWEILERA CALYCULATA Pittier, in Contrib. U. S. Nat. Herb. 12:97. *pls. 1–2*. 1908.

Trees up to 10 m. tall, or apparently sometimes more than twice as tall (according to Von Wedel), the leafy twigs relatively stout. Leaves rather narrowly obovate-oblong, obtuse or rounded to abruptly and obtusely acuminate, broadly and obtusely cuneate, 13–35 cm. long, 5–15 cm. broad, coriaceous, glabrous; petiole about 1–2 cm. long. Inflorescence racemose, several-flowered, the peduncle stout and glabrous, less than half as long as the subtending leaves. Flowers relatively large, about 3.5 cm. in diameter; calyx lobes broadly ovate, acute, about 6 mm. long, greatly accrescent in fruit but retaining their coriaceous texture and only weakly adnate to the base of the pyx (according to Pittier); petals oval-obovate, about 2 cm. long, rather unequal, yellow. Fruit (according to Pittier and the cited illustrations) "7 cm. in diameter and about 6 cm. high, depressed-globose, thin-walled, rather smooth, with persistent sepals becoming twice larger than in flower", the subhemispheric operculum nearly twice as deep as the body of the pyx, not conspicuously contracted at the orifice.

Lowland forests of the northwestern Atlantic slope of Panama, and adjacent Costa Rica. Reported as *mata cansada* by Cooper and Slater.

BOCAS DEL TORO: Isla Colón, Chiriquí Lagoon, *Von Wedel 2804, 408*; Almirante region, *Cooper & Slater 57*; Changuinola valley, *Dunlap 493*. CANAL ZONE: near Fort Randolph, *Maxon & Harvey 6537, Standley 28675*.

I have not been able, as yet, to examine well-authenticated fruits of *E. caly-*

culata. The fruits labeled such in the U. S. National Herbarium to accompany *Cooper & Slater 57* certainly are Couroupitas. Since Cooper and Slater also collected *Couroupita* in the Almirante region, the fruits probably should accompany *Cooper & Slater 11*, the type sheet of *C. parviflora* Standl.

7. COURATARI Aubl.

COURATARI Aubl. Pl. Guian. 2:723. 1775.

Lecythopsis Schrank, in Denkschr. Akad. Muench. 7:241. 1821.

Gigantic trees. Leaves usually of moderate or rather small size for the family, usually membranaceous and more or less pubescent, entire or inconspicuously crenulate, usually not congested at the tips of the twigs. Flowers rather small, in terminal panicles. Hypanthium obconic. Calyx deeply 6-lobed to subentire, not accrescent, vestigial in fruit. Petals 6, subequal, usually pink or rose. Androphore strongly bilaterally symmetrical, produced into a prominent, posterior hood spirally involute then reversely revolute, wholly staminodial and concealing the rather few minute fertile stamens of the central disc. Ovary 3-celled, containing numerous basal ovules; stigma sessile or subsessile, minutely 3-radiate. Fruit a mediocre subcoriaceous narrowly campanulate dehiscent pyx; seeds several, basal, very thin and broadly winged, the embryo subcentral.

A genus of approximately 20 described species, extending from Costa Rica to central Brazil.

1. COURATARI PANAMENSIS Standl. in Field Mus. Publ. Bot. 4:239. 1929.

Gigantic trees up to about 30 m. tall, the leafy branches moderately stout, prominently angled and minutely ferruginous-hirtellous when young. Leaves broadly oval, obtuse to rounded or very abruptly and obtusely cuspidate, broadly rounded at the base, 7–18 cm. long, 5–10 cm. broad, membranaceous, more or less conspicuously ferruginous-hirtellous on the midrib and veins; petiole about 1 cm. long. Inflorescences terminal, paniculate, several- to many-flowered, the stout minutely hirtellous peduncles somewhat longer than the subtending leaves. Flowers unknown to us. Fruits cylindrical-campanulate, occasionally somewhat gibbous, 5–10 cm. long, about 3.0–3.5 cm. in diameter at the orifice, dark brown and conspicuously lenticellate; operculum strongly trigonal, permanently attached to the stout elongate placenta; seeds oblong-oblanceolate, thinly membranaceous, about 7 cm. long and 1.5 cm. broad, rich brown.

Lowland forests of the Atlantic slope of Panama; perhaps also in lowland forests of eastern Costa Rica. Barbour reports the vernacular names of *coco, coco de mono* and *coquito* in Panama.

BOCAS DEL TORO: Cricamola valley, region of Almirante, *Cooper 542*. CANAL ZONE: near Battery VII, area west of Limón Bay, Gatún Locks and Gatún Lake, *Johnston s. n.* PANAMÁ: Río Indio drainage, about 9 miles east of trans-isthmian highway, *Barbour 1059*.

These three specimens, in addition to one other from Costa Rica, are the only

Fig. 42. *Couratari panamensis*

records of *Couratari* from Central America. The three Panamanian specimens show fruit only; the Costa Rican (*Allen 5686*, from the vicinity of Río Esquinas, Puntarenas province) is in flower. Whether a single species is represented is conjectural of course. The flowers of *Allen 5686* are pink and about 1.5–2.0 cm. in diameter; they were used in the composition of the accompanying illustration.

RHIZOPHORACEAE

By DAVID P. GREGORY

Trees or shrubs, often with swollen nodes. Leaves opposite, simple, entire or serrate, with lanceolate, foliose, interpetiolar, caducous stipules. Inflorescence axillary; flowers perfect and regular, sometimes solitary but usually cymose, perigynous to epigynous. Calyx 3- to 14-merous, the calyx tube adnate to the ovary or free, valvate, persistent. Petals equal in number to the sepals, free, often unguiculate and sometimes elaborately fimbriate, convolute or inflexed in the bud. Stamens from twice the number of sepals to more numerous, in one whorl, inserted on a lobed disc; anthers usually 2-celled, sometimes many-celled (*Rhizophora*). Ovary superior, half-inferior or inferior, the locules and carpels 2–5, the septa sometimes failing to develop and resulting in a single locule; placentation axile; ovules usually 2 per locule; style single, the stigma lobes usually equal in number to the carpels. Fruit a leathery or fleshy berry crowned by the persistent calyx, usually indehiscent but sometimes septicidally dehiscent, with one locule and one seed or 2–5 locules each 1-seeded. Seeds sometimes germinating while the fruit is still on the tree (*Rhizophora*), with or without endosperm.

This family has two groups of genera, one maritime and the other of upland forest genera. The representatives in Panama include one genus of each group, *Rhizophora* of the tidal zone and *Cassipourea* of inland areas. *Rhizophora* is the more important economically. The mangroves are a factor in land building, their prop roots forming a lattice that collects silt and organic debris. The bark of these plants contains from 20 to 45 per cent of tannins, although their tannin is apparently inferior to that of some other plants used in the process of tanning. Red dyes also are obtained from the young shoots. Other uses are as firewood and charcoal, for piling, for cabinet work and for manila and craft pulp.

Economic uses of *Cassipourea* are fewer, most important being the use of its strong, flexible wood for such things as canoe paddles.

a. Leaves coriaceous; ultimate branchlets thick; inflorescences axillary and cymose; stamens 8, cuneate, sessile or subsessile, the anthers many-locular; ovary half-inferior, 2-locular; fruit a dry indehiscent berry, the seed germinating in attached fruits; plants of mangrove swamps with characteristic adventitious aerial and prop roots..... 1. RHIZOPHORA

aa. Leaves membranaceous; ultimate branchlets slim; flowers fascicled in the leaf axils or solitary; stamens 15–25 on slender filaments, the anthers 4-locular; ovary nearly superior, 3-locular; fruit a fleshy septifragal capsule; not plants of the mangrove association, roots subterranean..... 2. CASSIPOUREA

1. RHIZOPHORA L.

RHIZOPHORA L. Sp. Pl. 1:443. 1753.

Mangle Pluk. ex Adans. Fam. Pl. 2:445. 1763.
Mangium Rumph. ex Scop. Intr. Hist. Nat. 218. 1777.
Asophora Neck. Elem. Bot. 2:361. 1790.

Maritime trees and shrubs with adventitious aerial and prop roots, branchlets stout and furrowed, with prominent leaf and stipule scars. Leaves opposite, simple, entire, evergreen, coriaceous, often spotted dorsally; stipules foliose, sessile, caducous. Inflorescence axillary, cymose, persistently bracteate. Flowers perfect, regular. Sepals 4, valvate, distinct, coriaceous, reflexed and persistent in fruit. Petals 4, alternate with the sepals, involute, often with hairy margins, caducous. Stamens 8–12, introrse, sessile, in one whorl, cuneate, areolate, a membrane covering the areolae opening at the inner edge to free the pollen. Ovary half-inferior, bilocular, the superior portion conical, surrounded by a fleshy disc; style terete, the stigma bifid or rarely trifid; ovules 2 per locule. Fruit a dry berry crowned by the persistent calyx, indehiscent. Seed 1 by abortion, suspended, germinating while the fruit is still on the tree.

Several species of tidal flats and river estuaries widely distributed between the Tropic of Cancer and the Tropic of Capricorn, girdling the world.

a. Shrubs reaching 5 meters (rarely trees reaching 25 meters); inflorescence 2- to 6-flowered; floral buds ampullaceous, broadest at the base, acuminate at the tip; sepals 8–15 mm. long at anthesis; petals 5–11 mm. long; style 3–7 mm. long; bracteoles truncate-trapezoid. Either coast.
  b. Flowers relatively large at anthesis, the sepals 11–15 mm. long, the petals 9–11 mm. long, the style 5–7 mm. long. Atlantic coast..... 1. R. MANGLE
  bb. Flowers relatively small at anthesis, the sepals 8–10 mm. long, the petals 5–8 mm. long, the style 3.5–4.0 mm. long. Pacific coast..... 2. R. SAMOENSIS
aa. Trees reaching 20 meters; inflorescence 10-to 50-flowered; floral buds ovoid, broadest near the middle, acute to obtuse at the tip; sepals at anthesis 8.0–8.5 mm. long; petals 6–7 mm. long; style 4.0–4.5 mm. long; bracteoles deltoid. Pacific coast..... 3. R. BREVISTYLA

1. RHIZOPHORA MANGLE L. Sp. Pl. 1:443. 1753.

Rhizophora americana Nutt. N. Amer. Sylv. 1:95. 1842.

Trees to 25 m. tall. Leaves obovate or elliptic, the apex obtuse, the base cuneate, slightly decurrent on the petiole, 7–15 cm. long, 2.0–8.5 cm. broad, glabrous, coriaceous; petiole 1.0–2.5 cm. long. Inflorescence once-dichotomous and 2-flowered, rarely trichotomous and 3-flowered; peduncles 1.5–3.5 cm. long; pedicels 0.5–2.0 cm. long; bracteoles truncate-trapezoid. Floral buds ampullaceous, broadest at the base, acuminate at the tip; sepals 11–15 mm. long, 4 mm. wide; petals involute, 9–11 mm. long, 2.0–2.5 mm. wide; stamens 8, 5.5–7.0 mm. long; ovary bilocular, half-inferior, the conical upper half terminating in a bifid style, the length of ovary from base of disc to tip of stigma 5–7 mm. Fruit 1.9–2.6 cm. long, 1.0–1.3 cm. wide, the protruding seedling up to 40 cm. long.

This species occurs along the Atlantic coast from Florida to Brazil and in the West Indies, and also occurs, though not so commonly, along the west coast of

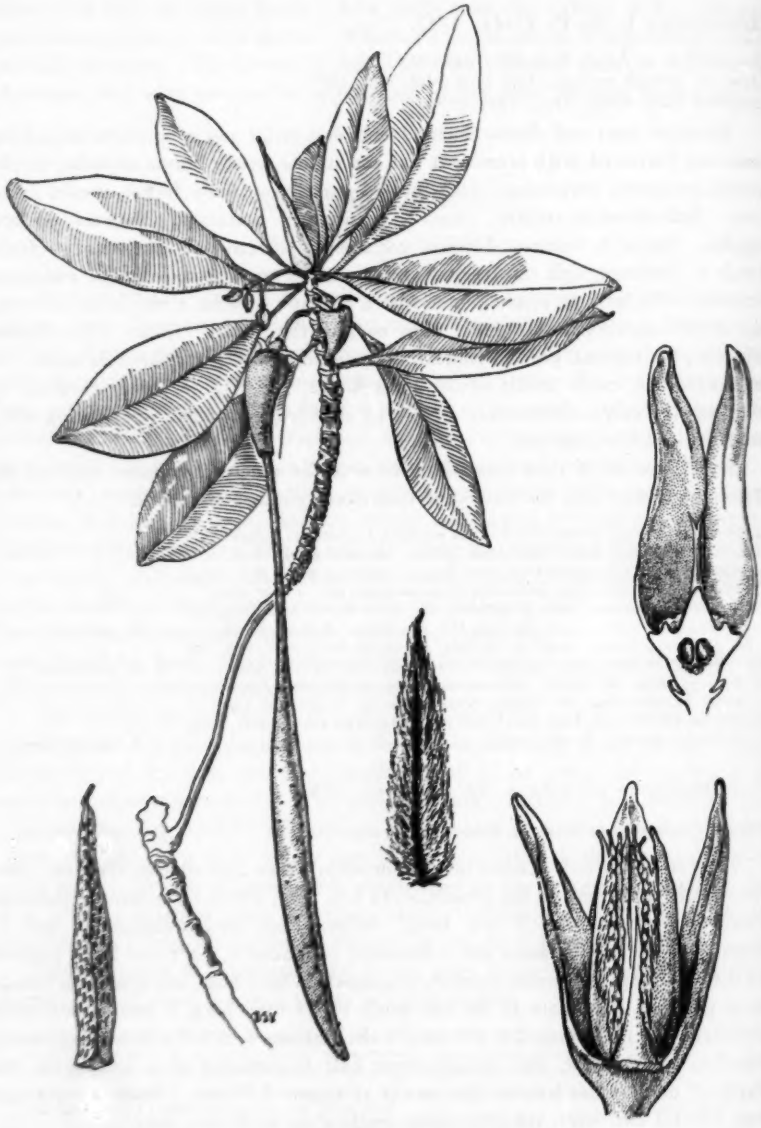

Fig. 43. *Rhizophora samoensis*

Africa. It grows only along the coast, either within the high tide zone or in lakes behind beaches or river estuaries in which it can become established. Under suitable conditions it forms dense stands in shallow water and apparently contributes to land building once it is established.

BOCAS DEL TORO: Nances Cay Island, *Von Wedel 577*; Water Valley, *Von Wedel 994*. CANAL ZONE: Cristóbal, *Salvoza 1010*; Manzanillo Island, *Hayes 46*. CHIRIQUÍ: vicinity of San Bartolomé, Peninsula de Burica, *Woodson & Schery 934*.

2. RHIZOPHORA SAMOENSIS (Hochr.) Salvoza, in Nat. and Appl. Sci. Bull. Philipp. 5:220. 1936.

Rhizophora mangle var. *samoensis* Hochr. in Candollea 2:447. 1925.

Shrubs to 5 m. tall. Leaves lanceolate, elliptic or ovate, the apex obtuse, the base cuneate, slightly decurrent on the petiole, 7.5–15.5 cm. long, 2.5–6.5 cm. broad, glabrous, coriaceous; petiole 0.5–2.5 cm. long. Inflorescence once or twice dichotomous and 2- to 4-flowered, rarely trichotomous and 3- to 6-flowered; primary peduncles 1.0–4.5 cm. long; pedicels 3–8 mm. long; bracteoles truncate-trapezoidal; sepals 8–10 mm. long, 3–4 mm. wide; petals involute, hairy at the margins, 5–8 mm. long, 1–2 mm. wide; stamens 8, 4.5–6.0 mm. long; ovary bilocular, half-inferior, the conical upper half terminating in a bifid style, length of ovary from base of disc to tip of stigma 3.5–4.0 mm.; disc fleshy, 1 mm. high. Fruit 1.5–2.5 cm. long, 1.0–1.5 cm. wide, the protruding seedling 25–35 cm. long.

This species occurs on the Pacific coast of Mexico, Central America, and South America from lower Baja California to Ecuador. It is also found on some of the Pacific islands. This plant is similar in size to the smaller form of *R. mangle* but, unlike *R. mangle* and *R. brevistyla*, it never grows to a large tree. Otherwise its ecology is probably similar to that of *R. mangle*, to which it seems closely related.

CANAL ZONE: Bella Vista, *Salvoza 1006*.

R. samoensis is very similar to *R. mangle* except for its smaller flowers, shorter style and constantly small habit and its distribution on the Pacific coast. The shape of the floral buds of this species is identical to that of *R. mangle* and the bracteoles are very similar. Although the floral buds of *R. samoensis* are of the same size as those of *R. brevistyla* they differ in shape, as do the bracteoles, and the inflorescence of *R. brevistyla* branches more and bears many more flowers.

The American plants seem to be identical with those from the Samoan Islands and since this species was first given nomenclatural recognition by Hochreutiner for Samoan material as a variety of *R. mangle*, the name *samoensis* is used. In Guppy's (Observations of a Naturalist in the Pacific II:449. 1906.) opinion this species is not fitted for oceanic dispersal from Central America into the Pacific, particularly because of likely damage to the exposed plumule. He postulates a former wide distribution of the species and subsequent diminution of range leaving the species in two widely separated areas, western America and the western Pacific islands.

3. RHIZOPHORA BREVISTYLA Salvoza, in Nat. and Appl. Sci. Bull. Philipp. 5:211. 1936.

Rhizophora racemosa Hieron. in Engl. Bot. Jahrb. 20:61. 1895, non Mey.

Trees to 20 m. tall. Leaves elliptic to broadly elliptic, the apex obtuse, the base cuneate, slightly decurrent on the petiole, 9.5–15.0 cm. long, 4.5–7.0 cm. broad, glabrous, coriaceous; petiole 1.5–2.0 cm. long. Inflorescence several times dichotomous with from 10–50 flowers; primary peduncles 1.5–3.5 cm. long; pedicels 0.3–1.0 cm. long; bracteoles deltoid. Floral buds ovoid, broadest near the middle, acute to obtuse at the tip; sepals 8.0–8.5 mm. long, 3.5–4.0 mm. wide; petals involute, 6–7 mm. long, 1.5 mm. wide; stamens 8, 5.5–6.0 mm. long. Ovary bilocular, half-inferior, the superior portion from the base of the disc to the tip of the bifid style 4.0–4.5 mm. long. Fruit 2.7–3.5 cm. long, 1.1–1.6 cm. broad, the protruding seedling 30–45 cm. long.

This species occurs on the Pacific coast from Panama to Ecuador. As described by I. M. Johnston (in Sargentia 8:222. 1949.) on San José Island, Panama, there are two types of growth form. The most common is a shrub reaching 6 meters in height, resembling *R. mangle* in general appearance and also resembling *R. samoensis* which grows with it in Panama and south along the Pacific coast. The other growth form is a tree reaching 20 meters in height. Johnston also points out the correlation between growth form and number of flowers per inflorescence in this species, the smaller plants having greatly reduced numbers of flowers, as few as 4–6 per inflorescence in the smallest ones.

CANAL ZONE: Bella Vista, *Salvoza 1007*; locality lacking, *Allen 1726*. PANAMÁ: San José Island, Pearl Archipelago, *Harlow 33, Johnston 253, 1357*; Saboga Island, Pearl Islands, *Miller 1963*.

2. CASSIPOUREA Aubl.

CASSIPOUREA Aubl. Hist. Pl. Guian. 1:528. 1775.

Tita Scop. Introd. 219. 1777.
Legnotis Sw. Prod. 84. 1788.
Richaeia Thou. Gen. Nov. Madag. 25. 1806.
Richeia Poir. Encycl. Supp. 4:680. 1816.
Weihea Spreng. Syst. 2:594. 1825.
Anstrutheria Gardn. in Calc. Journ. Nat. Hist. 6:344. 1846.
Dactylopetalum Benth. in Journ. Linn. Soc. 3:79. 1858.
Richea O. Ktze. Rev. Gen. 235. 1891. non R. Br. 1810.

Trees or shrubs, with slim branchlets. Leaves opposite, coriaceous or membranaceous, simple, with caducous interpetiolar stipules. Flowers perfect and regular, solitary to fascicled in the axils of the upper leaves, bracteate, with articulated pedicels. Calyx coriaceous, 4- to 7-lobed, valvate, hairy or glabrous, campanulate to spreading. Petals unguiculate and often elaborately fimbriate or lacerate, inflexed, pubescent or glabrous. Stamens 8–40, inserted on or outside the disc, filaments equal to or longer than the calyx. Ovary 2- to 4-locular, hypogynous or slightly adnate to the base of the calyx, surrounded by a fleshy or

Fig. 44. *Cassipourea elliptica*

membranaceous disc, each locule with 2 pendulous ovules; style filiform or stout. Fruit a fleshy capsule, septifragal; seeds 2–4, arillate.

About 60 species of mountains, river banks and sandy shores; tropical America, Africa (where the species are most numerous), Ceylon and southern India.

1. CASSIPOUREA ELLIPTICA (Sw.) Poir. Dict. Suppl. 2:131. 1811.

Legnotis elliptica Sw. Prod. 84. 1788.
Cassipourea alba Griseb. in Gōtting. Abh. 7:223. 1857.
Cassipourea elliptica β alba Griseb. Fl. of B. W. Indies 274. 1860.
Cassipourea elliptica γ pauciserrata Griseb. loc. cit. 1860.
Cassipourea cubensis Urb. Symb. Antill. 7:293. 1912.
Cassipourea podantha Standl. in Field Mus. Bot. 4:241. 1929.
Cassipourea macrodonta Standl. loc. cit. 242. 1929.

Shrubs or trees to 17 m. tall. Leaves elliptic or ovate, the apex acuminate or acute, the base cuneate, 5–16 cm. long, 2.0–6.5 cm. wide, the upper half sometimes serrate, glabrous, coriaceous or membranaceous; petiole 3–10 mm. long; stipules 4–5 mm. long, appressed pilose dorsally, soon caducous. Flowers numerous, occasionally solitary; pedicels 2–5 mm. long, articulated just beneath the flower, minutely bracteate at the base, strigose to glabrous. Calyx fleshy, campanulate, to 5 mm. long, with 4–5 lobes 2 mm. long, often stipitate at the base, sericeous within. Petals 4–5, spatulate, laciniate, pilose to glabrous. Stamens 15–25, the slender filaments sometimes united at the base, inserted on the outside of the fleshy disc. Ovary 3-locular, sericeous above at the base of the style; style slender, 4–5 mm. long, sericeous at the base or nearly to the stigma; stigma capitate. Fruit ovoid, crowned by the persistent calyx.

This species is widespread in the West Indies and in Central America, growing along rivers, near beaches, and in forested areas.

BOCAS DEL TORO: Old Bank Island, vicinity of Chiriquí Lagoon, *Von Wedel 2128*; Little Bocas, vicinity of Chiriquí Lagoon, *Von Wedel 2490*; Fish Creek Mts., vicinity of Chiriquí Lagoon, *Von Wedel 2244*; Fish Creek, vicinity of Chiriquí Lagoon, *Von Wedel 2231*; region of Almirante, Daytonia Farm, *Cooper 446*; Water Valley, vicinity of Chiriquí Lagoon, *Von Wedel 1554, 1658, 1659*; Changuinola Valley, *Dunlap 447*; Bastimentos, Mariano Creek, vicinity of Chiriquí Lagoon, *Von Wedel 2897*; vicinity of Chiriquí Lagoon, *Von Wedel 1268, 1268A*; locality lacking, *Von Wedel 386*. CANAL ZONE: Manzanillo Island, *Hayes 51*; near Fort Randolph, *Standley 28640*; south of Fort Sherman, *Johnston 1767*; Barro Colorado Island, *Bangham 566, 416, Salvoza 840, 970, Wetmore & Abbe 161, Woodworth & Vestal 527*. CHIRIQUÍ: vicinity of San Félix, *Pittier 5741*. COLÓN: Chagres, *Fendler 191*. DARIÉN: vicinity of La Palma, *Pittier 5483, 6617*; Cana-Cuasi Trail, Real?, *Terry & Terry 1562*. PANAMÁ: San José Island, Perlas Archipelago, *Johnston 112, 114, 223, 340, 421, 558, Erlanson 65, 203, 390, 472, 514, Harlow 16*.

The leaves of this species are quite variable in both size and shape, segregated species having been named principally on local extreme leaf variation. Standley's *C. macrodonta* is such an extreme local variant, centered in the Changuinola Valley and around the Chiriquí Lagoon, its leaves being more membranaceous with a longer apex and often with longer teeth, but these characteristics are sometimes found singly in typical *C. elliptica* and are not correlated with differentiating floral characteristics. This plant is not clearly enough defined from *C. elliptica* to warrant specific rank. Standley's *C. podantha* is not even an extreme variant, and it cannot be distinguished from *C. elliptica*.

COMBRETACEAE

By A. W. EXELL

Trees, shrubs or lianas, rarely subherbaceous (never in Panama). Leaves opposite, verticillate, alternate or spiral, exstipulate, simple, almost always entire. Flowers perfect or perfect and staminate in the same inflorescence, usually actinomorphic, sometimes slightly zygomorphic, in axillary or extra-axillary, elongated or subcapitate spikes or racemes or in terminal and sometimes axillary panicles. Receptacle (hypanthium) usually in two distinct parts, the lower receptacle surrounding the ovary and adnate to it and the upper receptacle (calyx-tube) produced beyond it to form a short or long tube terminating in the (sometimes poorly developed) calyx-lobes, caducous or persistent. Calyx-lobes 4–5 (rarely 6–8 or almost obsolete) sometimes accrescent (not in Panama genera). Petals 4–5 or absent, conspicuous or very small. Stamens usually twice as many as the sepals or petals, borne inside the upper receptacle, usually in two series, exserted or included, anthers versatile or more rarely adnate to the filaments and immobile. Disk usually present, often hairy, intrastaminal. Style free in American genera (partly attached to the upper receptacle in *Quisqualis*). Ovary completely inferior in all American genera (semi-inferior in the West African genus *Strephonema*), unilocular, with usually 2 (sometimes up to about 6) pendulous ovules of which only one usually develops. Fruit (pseudocarp) very variable in size and shape, fleshy or dry, usually indehiscent, often variously winged or ridged, 1-seeded.

The Combretaceae, an entirely tropical and subtropical family, found in rainforest, deciduous forest, savanna and mangrove formations, comprise 18 genera of which two, *Combretum* and *Terminalia*, contain the great majority of species. Some species of *Terminalia* yield useful timber and the 'myrobalans' used for dyeing in Asia. A few species of *Combretum* are cultivated in the tropics and as stove-plants in temperate countries. *Terminalia catappa* L., a native of tropical Asia and Polynesia, is often planted in towns as an avenue tree and *Quisqualis indica* L., the Rangoon Creeper, is a climber often grown in tropical gardens.

In the course of their evolution the Combretaceae seem to have developed under the influence of two principal tendencies: (1) the attraction of pollinating insects by the massing of relatively small flowers in dense or rather dense inflorescences, though with a number in individual exceptions (such as *Combretum cacoucia*); (2) dispersal of the fruits by means of laterally extended wings (again with numerous exceptions). The progressive development of inflorescences and fruits along these lines leads to obvious space difficulties as the more the flowers are crowded into pseudo-capitate spikes the less room there is for the development of wings to the fruits. Several of the genera recognized in the family represent different solutions to this problem. In Panama we have one of the most 'advanced' solutions in the genus *Conocarpus* where the flattened pseudocarps, perhaps after a secondary reduction in the wings, are tightly packed into a cone-like aggregate fruit. The fact that isolated species of *Combretum*, belonging to quite different sections, have

wingless or nearly wingless fruits, often distributed by water, may also indicate that wingless fruits have developed from winged ones.

In the various forms which the winging of the fruit may take we have an interesting combination of two factors. From the inferior ovary, probably originating from a single carpel, embedded in receptacular tissue, there is apparently what we might call an 'internal' tendency to produce a 2-winged fruit resulting from the bilateral symmetry of the carpel. From the 4-merous or 5-merous calyx, on the other hand, there seems to be an 'external' tendency to produce a 4-winged (*Combretum*) or 5-winged (*Combretum* and *Terminalia*) fruit. In *Terminalia*, in particular, it is interesting to see the effect of these two tendencies. We find, for example, in addition to numerous species with either 2-winged or 5-winged fruits respectively, certain species, such as *T. amazonia* in Panama, with primarily 2-winged fruits in which three secondary wings or ridges are also developed. If this interpretation is correct it would seem that the great plasticity in the winging of the fruit is due to the surrounding, in an inferior fruit, of a bilateral 'core' by a 4-merous or 5-merous 'skin'.

a. Receptacle (hypanthium) without adnate bracteoles; petals present or absent.
  b. Petals present (in Panama species) ..... 1. COMBRETUM
  bb. Petals absent.
    c. Fruits solitary, not closely aggregated.
      d. Anthers versatile.
        e. Calyx-lobes triangular; upper receptacle and calyx caducous (in Panama species) before the fruit ripens ..... 2. TERMINALIA
        ee. Calyx only slightly toothed; upper receptacle and calyx persistent on the fruit or only tardily dehiscent ..... 3. BUCIDA
      dd. Anthers adnate to the filaments, immobile ..... 4. BUCHENAVIA
    cc. Fruits aggregated into a cone-like structure ..... 5. CONOCARPUS
aa. Receptacle (hypanthium) with two small adnate bracteoles near the apex; petals present ..... 6. LAGUNCULARIA

The introduced genus *Quisqualis* (receptacle without adnate bracteoles; petals present) is separated from *Combretum* by the adnation of the style for part of its length to the wall of the upper receptacle (calyx-tube). The species cultivated, *Q. indica*, can at once be distinguished from all the indigenous Combretaceae by its much elongated, narrowly infundibuliform upper receptacle (calyx-tube), up to 8 cm. long when the flowers are fully developed.

1. COMBRETUM Loefl.

COMBRETUM Loefl. Iter. Hispan. 308. 1758, nom. conserv.

Grislea L. Sp. Pl. 348. 1753; Gen. Pl. 164. 1754.
Aetia Adans. Fam. 2:84, 513. 1763.
Cacoucia Aubl. Pl. Guian. 1:450. *t. 179*. 1775.
Hambergera Scop. Introd. Hist. Nat. 106. 1777.
Cristaria Sonner. Voy. Ind. Orient. 2:247. *t. 140*. 1782.
Hambergia Neck. Elem. Bot. 141. 1790.
Schousboea Willd. in L. Sp. Pl. 2:578. 1799.
Poivrea Comm. [ex Juss. Gen. Pl. 320. 1789, in syn. (sphalm. "*Pevraea*")] ex Thou., Obs. Pl. Il. Austr. Afr. 28. 1811.
Gonocarpus Ham. Prodr. Pl. Ind. Occ. 39. 1825.
Forsgardia Vell. Fl. Flum. 4:152. 1825; *t. 13*. 1835.

Chrysostachys Pohl, Fl. Bras. 2:65. *t. 143.* 1831.
Sheadendron Bertol. f. in Mem. Acad. Bologn. 2:574. *t. 4.* 1850.
Embryogonia Bl. Mus. Lugd. Bat. 2:122. 1852.
Bureava Baill. in Adans. 1:171. 1860–61.
Seguiera Reichb. ex Oliv. Fl. Trop. Afr. 2:424. 1871 in syn., non Adans. (1763).
Campylochiton Welw. ex Hiern, Cat. Afr. Pl. Welw. 2:353. 1898.

Trees, shrubs or woody climbers, very rarely subherbaceous. Leaves opposite, verticillate or more rarely alternate, usually petiolate, almost always entire, often conspicuously lepidote. Petioles sometimes persisting after leaf-fall, forming thorns. Flowers usually perfect, actinomorphic or rarely slightly zygomorphic, in elongated or subcapitate, axillary or extra-axillary spikes or racemes or in terminal or terminal and axillary, often leafy panicles. Receptacle usually clearly divided into a lower part (lower receptacle) surrounding and adnate to the ovary and an upper part (upper receptacle) varying from patelliform to elongate-infundibuliform terminating in the calyx-lobes. Upper receptacle often further differentiated into a lower part containing the disk and a usually more expanded upper part. Calyx-lobes usually 4 or 5 (rarely more) deltoid to filiform or sometimes scarcely developed. Petals usually 4 or 5 (very rarely absent but never in Panama species except perhaps by abortion) small and inconspicuous or showy and exceeding the calyx-lobes, white, yellow, orange, red or purple, glabrous or hairy, occasionally scaly. Stamens usually twice as many as the petals, inserted inside the upper receptacle, often biseriate, usually exserted; anthers dorsifixed, versatile. Disk intrastaminal, glabrous or hairy, sometimes very small or absent. Ovary completely inferior, probably of 1 carpel, unilocular with usually 2 (occasionally up to 6) pendulous ovules of which only 1 develops. Style simple, free, usually exserted, rarely very short. Fruit (pseudocarp) 4- to 5-winged, -ridged or -angled, sessile or stipitate, usually indehiscent, 1-seeded; pericarp usually thin and papery, sometimes leathery, more rarely fleshy.

About 250 species throughout the tropics (except Australia); extending in the New World from Mexico to Argentina.

The Panama species are classified as follows:

A. Sect. EUCOMBRETUM Don.: *C. fruticosum* (Loefl.) Stuntz; *C. sambuense* Pittier
B. Sect. CACOUCIA (Aubl.) Engl. & Diels.: *C. cacoucia* Exell.
C. Sect. COMBRETASTRUM Eichl.: *C. laxum* Jacq.
D. Sect. SPINOSAE Exell.: *C. decandrum* Jacq.; *C. spinosum* Bonpl.

a. Flowers tetramerous.
  b. Flowers measuring at least 7 mm. from the rhachis to the tips of the calyx-lobes, conspicuously scaly; disk well developed, margin pilose.
    c. Scales of inflorescence usually golden-brown (in dried specimens). Petals rarely more than 1.5 mm. long ..... 1. C. FRUTICOSUM
    cc. Scales of inflorescence red (in dried specimens). Petals 4–5 mm. long ..... 2. C. SAMBUENSE
  bb. Flowers much smaller, less than 5 mm. from the rhachis to the tips of the calyx-lobes, not conspicuously scaly, in terminal panicles; disk inconspicuous, glabrous ..... 4. C. LAXUM
aa. Flowers pentamerous.
  b. Flowers actinomorphic, small, measuring less than 5 mm. from the rhachis to the tips of the calyx-lobes. Fruit broadly winged.

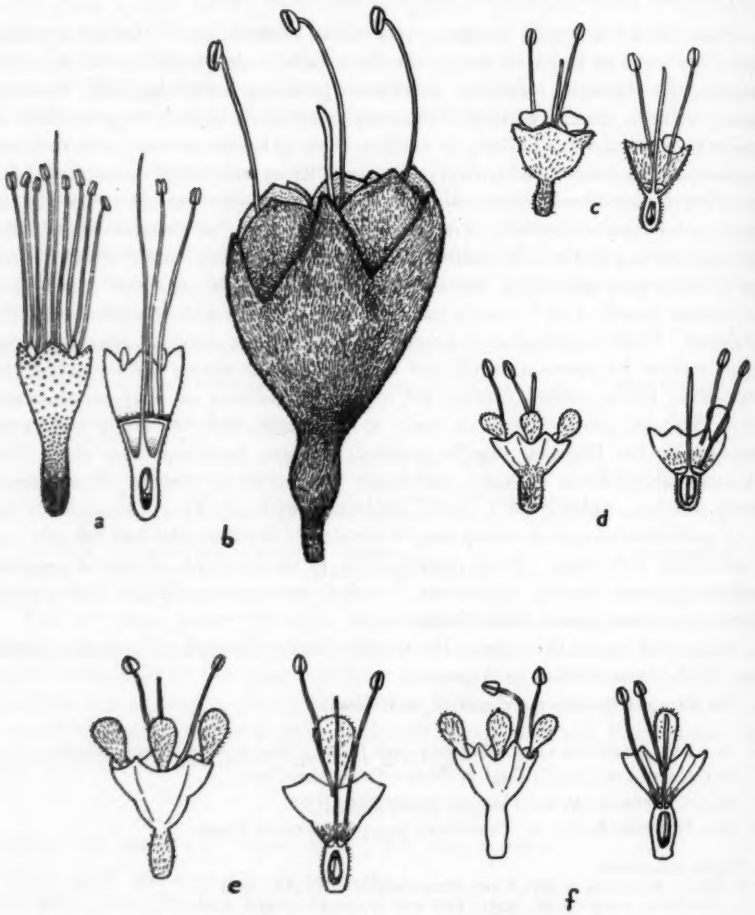

Fig. 45. *Combretum*: Diagrams of Flower Structure. (a) *C. fruticosum*; (b) *C. cacoucia*; (c) *C. laxum*; (d) *C. spinosum*; (e) & (f) *C. decandrum*. By courtesy of Linnean Society of London.

c. Lower receptacle, nearly glabrous or patent-pubescent, slightly pedicellate and narrowed at the apex..... 5. C. DECANDRUM
cc. Lower receptacle appressed-pubescent, sessile, scarcely narrowed at the apex..... 6. C. SPINOSUM
bb. Flowers slightly zygomorphic, relatively large, up to 3 cm. from the rhachis to the tips of the calyx-lobes. Fruit narrowly winged or ridged..... 3. C. CACOUCIA

1. COMBRETUM FRUTICOSUM (Loefl.) Stuntz, in U. S. Dept. Agric. Bur. Pl. Ind. Seeds & Pl. Import. no. 31:86. 1914.

Gaura fruticosa Loefl. Iter. Hispan. 248. 1758.
Combretum occidentale L. Syst. Nat. 2:999. 1759, nom. illegit.
Combretum secundum Jacq. Enum. Syst. Pl. Ins. Carib. 19. 1760.
Combretum laxum sensu L. Sp. Pl. 1:496. 1762, pro parte, non Jacq.
Combretum formosum Don, in Trans. Linn. Soc. Lond. 15:420. 1827.
Combretum micropetalum DC. Prodr. 3:19. 1828.
Combretum aurantiacum Benth. in Hook. Lond. Journ. Bot. 2:222. 1840.
Combretum loeflingii Eichl. in Mart. Fl. Bras. 14^2:110. 1867, nom. illegit.
Combretum warszewiczianum Eichl. loc. cit. 1867.
Combretum benthamianum Heurck & Müll. Arg. Obs. Bot. 220. 1870.
Combretum gloriosum Rusby, in Mem. Torr. Bot. Club 6:35. 1896.
Combretum farinosum var. *phaenopetalum* J. D. Sm. in Bot. Gaz. 23:7. 1897.
Combretum superbum Pittier, in Contrib. U. S. Nat. Herb. 18:242. 1917.
Combretum phaenopetalum (J. D. Sm.) Pittier, loc. cit. 243. 1917.
Combretum lepidopetalum Pittier, loc. cit. 245. 1917.
Combretum multidiscum Rusby, Descr. New Sp. S. Amer. Pl. 69. 1920.
Combretum loeflingii subsp. *ornithophilum* Suesseng. in Mitteil. Bot. Staatssamml. Münch. 14. 1950.

For an explanation of some complicated points in the synonymy see Exell, in Journ. Linn. Soc. Lond. 55:117. 1953.

Shrub of 3–8 m. or liana, branchlets somewhat quadrangular, scaly at first but otherwise glabrous (in Panama specimens). Leaves papyraceous or chartaceous, opposite, petiolate; petioles scaly, 7–10 mm. long; lamina elliptic to broadly elliptic, 5–12 × 3–7 cm., minutely verruculose above, conspicuously scaly beneath, scales usually golden or golden-brown, occasionally reddish, dense but scarcely marginally contiguous, usually glabrous or nearly so in Panama but variously hairy in other regions, rather bluntly acuminate at the apex, cuneate or rounded at the base. Flowers yellow or greenish-yellow, 4-merous, sessile or subsessile in terminal panicles of spikes and lateral spikes, rhachis scaly. Lower receptacle (ovary) quadrangular, 2–3 mm. long, densely scaly; upper receptacle clearly differentiated into two parts, a lower narrowly infundibuliform part containing the disk and an upper broadly infundibuliform or campanulate part terminating in the calyx-lobes, measuring about 7–8 mm. from the apex of the ovary to the tips of the calyx-lobes, with conspicuous golden or golden-brown (rarely reddish) scales otherwise nearly glabrous (in Panama). Calyx-lobes broadly ovate, about 2 mm. long. Petals yellow, usually glabrous, very variable in size and shape but usually not more than 1–1.5 mm. long, shorter than the calyx-lobes. Stamens 8, filaments 15–20 mm. long, anthers about 1 mm. long. Disk infundibuliform with a pilose margin. Style 15–20 mm. long, glabrous. Fruit subspherical in outline, 14–18 mm. in diameter, reddish-brown or purple, with 4 flexible wings about 6 mm. wide, scaly, shortly stipitate.

Fig. 46. *Combretum fruticosum*

Widespread in the New World from Mexico to Argentina.

For an account of the variability of this species see Exell, in Journ. Linn. Soc. Lond. 55:121. *fig. 3.* 1953.

Specimens of this species, as here delimited, have often been named *C. farinosum* Kunth, a species which, in my opinion, extends only from Mexico to Costa Rica. It is not easy to give cenventional key characters to separate these two species, especially in view of the wide range of variation I have included in *C. fruticosum.* Unfortunately I have never had the opportunity of examining living specimens, but really well-preserved herbarium specimens of the two species are quite different in appearance. In *C. farinosum* the flowers (receptacles) look silvery-grey, the petals dry red or dark red, the golden or reddish filaments make a considerable contrast in color with the receptacle and the dried anthers are about 1.5 mm. long. In *C. fruticosum* the inflorescences of modern, carefully prepared specimens are of a greenish golden-brown color (reddish in older specimens), the petals dry yellow and the dried anthers do not exceed 1 mm. in length.

It is possible to have a merry time making 'species' out of this complex for there is an extraordinary range of variation in the petals and in the indumentum. Add to this a number of ancient nomenclatural tangles and it is easily understandable how this species became so richly endowed with synonyms.

COCLÉ: between Aguadulce and Río Chico, *Pittier 5006*; near Penonomé, *Williams 72.* CANAL ZONE: near Cristóbal, Colón, *Broadway 162, 589*; near Salamanca Hydrographic Station, alt. 70–80 m., *Dodge, Steyermark & Allen 17981*; Río Grande, *Hayes 446*; Punta Paitillo, *Heriberto 214*; between Empire and Mandinga, *Piper 5489*; near Culebra, *Pittier 2158*; near Fort Sherman, *Standley 31016*; near Miraflores, *P. & G. White 50.* PANAMÁ: near San Carlos, alt. 0–10 m., *Allen 1142*; Bejuco, *Allen 2888*; near Bejuco, *Dodge, Hunter, Steyermark & Allen 16730*; near Panamá, *Hayes 446*; Perlas Archipelago, San José Island, *Johnston 908*; near Panamá, *Sargent 10*; Bella Vista, *Standley 25308*; Corozal Road, near Panamá, *Standley 28081.* HERRERA: near Ocú, alt. 100 m., *Allen 4052.* VERAGUAS: hills west of Soná, alt. c. 500 m., *Allen 1065.* PROVINCE UNKNOWN: *Duchassaing s. n.*; *Halsted s. n.*; *Hayes 308*; *Killip 3295*; *Seemann s. n.*

The specimen collected by P. & G. White, at Miraflores, is noted as being a 'large tree'. This may be an error.

2. COMBRETUM SAMBUENSE Pittier, in Contrib. U. S. Nat. Herb. 18:242. 1917.

Woody liana, branchlets glabrous, slightly quadrangular. Leaves chartaceous to subcoriaceous, opposite, petiolate; petiole 5–10 mm. long, scaly; lamina ovate to broadly elliptic, 11–18 × 5.5–9.5 cm., glabrous, minutely verruculose above with conspicuous golden-yellow scales beneath, scales rarely marginally contiguous, usually acuminate at the apex and rounded at the base. Flowers reddish or purplish, 4-merous, sessile, in terminal panicles of spikes and lateral axillary spikes, rhachis densely rufous-scaly. Lower receptacle (ovary) quadrangular, 5 mm. long, densely rufous-scaly; upper receptacle fleshy, broadly infundibuliform, slightly narrowed towards the base, measuring about 10 mm. to the tips of the calyx-lobes, densely rufous-scaly outside, villous within. Calyx-lobes ovate, 4–5 mm. long. Petals 4, yellow, broadly elliptic, acute, 4–5 mm. long, glabrous, slightly shorter than the calyx-lobes. Stamens 8, inserted at the margin of the disk, filaments 25–35 mm.

long, anthers 2 mm. long. Disk infundibuliform, pilose at the margin. Style 35–40 mm. long, glabrous. Fruit crimson, suborbicular, 1.8–2.5 cm. in diameter, scaly and minutely pubescent.

DARIÉN: near Pinogana, alt. 20 m., *Allen 4275*; Río Sambú, *Pittier 5548*; Tuculi, Chepigana, alt. 16 m., *Terry & Terry 1375*.

3. COMBRETUM CACOUCIA Exell, apud Sandw. in Bull. Misc. Inf. Kew, 1931:469. 1931.

Cacoucia coccinea Aubl. Pl. Guian. 1:450. *t. 179*. 1775.
Schousboea coccinea (Aubl.) Willd. in L. Sp. Pl. 2:578. 1779.
Terminalia cacoucia Baill. Hist. Pl. 6:275. 1877, nom. illegit.
Combretum coccineum (Aubl.) Engl. & Diels, in Engl. Mon. Afr. Pflanz. -Fam. & -Gatt. 3:110. 1899, nom. illegit., non Lam. (1785).

Shrub or liana, branchlets rufous-pilose. Leaves chartaceous, opposite, petiolate, petiole 5–8 mm. long, pilose, lamina broadly elliptic to oblong-elliptic, up to 20 × 10 cm., often pilosulose or pubescent on the midrib and principal nerves beneath, otherwise glabrous or nearly so, not conspicuously lepidote, acuminate at the apex and subcordate at the base, lateral nerves 7–8 pairs rather widely spaced. Flowers red, 5-merous, slightly zygomorphic, shortly pedicellate, pedicel 3–5 mm. long tomentellous, in stout terminal racemes up to 40 cm. long, rhachis tomentellous or velutinous, bracts ovate-acuminate or lanceolate, up to 15 mm. long, caducous. Lower receptacle (ovary) tomentellous, about 5 × 2.5 mm.; upper receptacle (calyx-tube) campanulate or broadly infundibuliform, slightly curved, up to 15 × 11 mm., sericeous outside. Calyx-lobes triangular, up to 5 mm. long. Petals 5, ovate or elliptic, mucronate, 10 × 7 mm., minutely pubescent on the outside or nearly glabrous. Stamens 10, exserted, filaments about 20 mm. long, anthers 1.2–1.5 mm. long. Disk well-developed with margin produced into an annular ridge which nearly closes the upper receptacle. Style 25 mm. long, glabrous. Fruit narrowly oblong-ellipsoid, longitudinally 5-ridged, up to 6 × 2 cm., velutinous at first, eventually nearly glabrous.

British Honduras to Brazil.

BOCAS DEL TORO: Water Valley, *Von Wedel 1628, 1902*; Old Bank Island, *Von Wedel 1979*; Fish Creek lowlands, *Von Wedel 2373*. CANAL ZONE: Majunga Swamp, neighborhood of Río Chagres, *Allen 854*; Gatún, *Hayes 8, s. n.*; Lion Hill Station, *Hayes 541*; Gatún, *Heriberto 110*; Río Chagres, below Gatún, *Maxon 4798*; Frijoles, *Pittier 2692*. COLÓN: Camp Piña, 0–50 m., *Allen 3432*; Río Culebra, above Sta. Isabel, *Pittier 4169*.

For a discussion of the significance of the geographical distribution of *Combretum* Sect. CACOUCIA, to which this species belongs, see Exell, in Journ. Linn. Soc. Lond. 55:104. 1953.

4. COMBRETUM LAXUM Jacq. Enum. Pl. Carib. 19. 1760.

Combretum puberum Rich. in Act. Soc. Hist. Nat. Par. 1:108. 1792.
Combretum obtusifolium Rich. loc. cit. 1792.
Combretum mexicanum Bonpl. Pl. Aequinox. 2:159. *t. 132*. 1809.
Forsgardia laevis Vell. Fl. Flum. 152. 1825.
Combretum odoratum Pav. ex Don, in Trans. Linn. Soc. Lond. 15:430. 1827.
Combretum cordatum Don, loc. cit. 440. 1827.
Combretum ferrugineum Don, loc. cit. 1827.

Combretum bugi Cambess. in St.-Hil. Juss. & Cambess., Fl. Bras. Merid. 2:247. *t. 130.* 1829.
Chrysostachys ovatifolia Pohl, Pl. Bras. 2:66. *t. 143.* 1831.
Combretum variabile Mart. in Flora 22, Beibl. 1:62. 1839.
Combretum pulchellum Mart. loc. cit. 64. 1839.
Combretum ferrugineum Hoffmansegg, ex Mart. loc. cit. 1839.
Combretum adenophyllum Mart. in Flora 24, Beibl. 2:1. 1841.
Combretum terminalioides Steud. in Flora 26^2:762. 1843.
Combretum jacquinii Griseb. Fl. Brit. W. Ind. 275. 1860, nom. illegit.
Combretum viscidum Wright, ex Griseb. Cat. Pl. Cub. 109. 1866.
Combretum accedens Heurck & Muell. Arg. in Heurck. Obs. Bot. 234. 1870.
Combretum odoratissimum Sessé & Moc. Fl. Mex. 90. 1894.
Combretum epiphyticum Pittier, in Contrib. U. S. Nat. Herb. 18:247. 1917.
Combretum oblongifolium Rusby, Descr. New Sp. S. Amer. Pl. 70. 1920.
Combretum marchii Fawc. & Rendle, in Journ. Bot. 63:115. 1925.
Combretum brunnescens Gleason, in Bull. Torrey Bot. Club 53:291. 1926.

The infra-specific taxa have been omitted. They are cited by Exell, in Journ. Linn. Soc. Lond. Bot. 55:127. 1953.

Liana (sometimes a shrub ?), branchlets rufous- or tawny-tomentose to almost glabrous. Leaves chartaceous to subcoriaceous, opposite, petiolate, petioles 2–7 mm. long, tomentose to almost glabrous, lamina oblong or oblong-elliptic to broadly ovate or suborbicular, 6–18 × 3–7 cm., not conspicuously scaly, varying from tomentose to nearly glabrous, usually acuminate sometimes subcaudate at the apex, rounded or subcordate at the base. Flowers white or yellow, small, fragrant, sessile, 4-merous, in terminal or terminal and axillary panicles, rhachis rufous- or fulvous-tomentose, tomentellous or pubescent. Lower receptacle 1–1.5 mm. long, tomentose, tomentellous, pubescent or nearly glabrous; upper receptacle cupuliform, 1–2 × 1.5–2.5 mm., densely pubescent to nearly glabrous. Calyx-lobes deltoid, about 0.7 mm. long. Petals 4, broadly obovate to transversely elliptic or subreniform, about 1 mm. in diam., glabrous, exceeding the calyx-lobes. Stamens 8, filaments about 4 mm. long, anthers 0.5 mm. long. Disk small, glabrous. Style 2.5–4 mm. long. Fruit oblong, narrowly ovoid or suborbicular, 4-ridged or -winged, 2.4 × 1.5–2 cm., pubescent or glabrous.

Widespread in the tropics and subtropics of the New World from Mexico to northern Argentina.

CANAL ZONE: Quebrada Tranquilla, alt. 70–80 m., *Dodge & Allen 17501*; near Gatún, *Hayes 7, s. n.*; Frijoles, *Hayes 54, s. n.*; Cano Quebrado, *Pittier 6668, 6819*; Río Chagres, *Steyermark & Allen 16774*. PROVINCE UNKNOWN: *Hayes 771*; *Seemann 1658*.

As in the preceding species a very broad view has been taken here. Those who wish for a narrower delimitation of the species will find names available in the synonymy for at least many of the taxa they may wish to recognize. In Panama, *Dodge & Allen 17501*, *Seemann 1658* and *Steyermark & Allen 16774* on the one hand and *Hayes 54* on the other represent extremes of variation and could be separated specifically with the greatest of ease. The three former specimens, in the event of such segregation, would seem to agree well with the Mexican material of *C. mexicanum* Bonpl. It is only when the species is studied over the whole hemisphere, especially with regard to the extraordinary range of variation in Brazil,

that the problem arises. The present conception of the species is, however, more a temporary convenience than a final solution. It is necessary to have far more fruiting material, at present very poorly represented in the herbaria. Included in the 'species', in its present conception are both narrowly angled and quite broadly winged fruits. If these differences could be correlated in any way with differences of leaf-shape and indumentum we should be on the way towards a more satisfactory system. Judging from what occurs in other species of *Combretum* and *Terminalia* in other parts of the world, one would expect to find ridged and angled fruits in flooded regions, along river-banks, etc. where distribution is by water, while species with broad-winged fruits are found in hill-slope and mountain forests, savannas etc. Field observations are badly needed.

5. COMBRETUM DECANDRUM Jacq. Enum. Pl. Carib. 19. 1760.

Combretum alternifolium Pers. Syn. 1:412. 1805, nom. illegit.
Gonocarpus jacquinii Hamilt. Prodr. Fl. Ind. Occ. 39. 1825, nom. illegit.
Poivrea alternifolia (Pers.) DC. Prodr. 3:17. 1828, nom. illegit.
Combretum palmeri Rose, in Contrib. U. S. Nat. Herb. 5:136. 1897.
Combretum nicoyanum Pittier, loc. cit. 18:247. 1917.
Combretum latepaniculatum Rusby, Descr. New Sp. S. Amer. Pl. 69. 1920.

Liana, branchlets pubescent or glabrous, spiny. Leaves alternate or sometimes subopposite, papyraceous, petiolate, petiole 2–5 mm. long, pubescent to tomentose, persistent and somewhat accrescent forming a spine, lamina elliptic to broadly elliptic, 5–14 × 3–7.5 cm., pubescent, especially on the nerves beneath, or nearly glabrous, often with hairy domatia in the axils of the nerves beneath, bluntly acuminate at the apex, blunt, rounded or subcordate at the base. Flowers white, subsessile or shortly pedicellate, 5-merous, in large terminal panicles, often with reduced leaves at the points of branching, rhachis tomentose, pubescent or glabrous. Lower receptacle about 1 mm. long, glabrous, nearly glabrous or loosely patent-pubescent, usually somewhat constricted at the apex and often with a short pedicel up to about 0.5 mm. long; upper receptacle campanulate to cupuliform, 2.5–3 × 1.5–2 mm., glabrous. Calyx-lobes 5, broadly deltoid, about 0.5 mm. long. Petals 5, obovate or obovate-elliptic, 2–3 × 1.5–1 mm., hairy. Stamens 10, filaments 3–5 mm. long, anthers 0.4 mm. long. Disk small, fleshy, glabrous, surrounding the base of the style. Style about 4 mm. long. Fruit suborbicular in outline, 1.5 cm. in diam., usually glabrous, 5-winged, wings thin, flexible, 5–6 mm. broad.

From Mexico to Colombia.

CANAL ZONE: Victoria Fill, near Miraflores Locks, *Allen 1746*; Empire Station, *Hayes 31*; near Gorgas Memorial Laboratory, *P. White 82*. DARIÉN: Patino, *Pittier 6607*.

6. COMBRETUM SPINOSUM Bonpl. Pl. Aequinox. 2:161. 1809.

Combretum guayca Humb. Rel. Hist. 3:3. 1825, nom. nud.
Poivrea eriopetalum DC. Prodr. 3:18. 1828.
Combretum eriopetalum (DC.) Don Gen. Syst. 2:665. 1832.
Combretum punctulatum Pittier, in Contrib. U. S. Nat. Herb. 18:248. 1917.

This differs from the preceding species only in having slightly smaller sessile flowers with the lower receptacle (ovary) appressed-pubescent and scarcely con-

stricted at the apex. One specimen, from Venezuela, with 4-merous flowers has been seen.

Panama, Venezuela and in the West Indies from Cuba to Trinidad.

CANAL ZONE: Río Trinidad, *Pittier 4002*.

It may prove necessary to unite this with *C. decandrum* when more material becomes available. *Allen 1746*, placed under *C. decandrum*, which I have now seen for the first time, has some appressed pubescence on the lower receptacle though it agrees in other respects with *C. decandrum*. The distribution areas of the two species, if such they be, overlap in Panama and there may well have been some hybridization.

2. TERMINALIA L.

TERMINALIA L. Syst. Nat. 2:674 (err. 638). 1767; Mant. Pl. 21. 1767, nom. conserv.

Adamaram Adans. Fam. 2:445. 1763, proparte excl. Hort. Malab. 4: *t. 5*. 1682.
Panel Adans. loc. cit. 447. 1763, pro parte quoad Hort. Malab. 4: *t. 10*. 1682.
Myrobalanifera Houtt. Handleid. Pl. Kruidk. 2:485. *t. 10, fig. 2*. 1774.
Tanibouca Aubl. Pl. Guian. 1:448. *t. 178*. 1775.
Pamea Aubl. loc. cit. 2:946. *t. 359*. 1775.
Kniphofia Scop. Introd. Hist. Nat. 327. 1777.
Aristotelia Comm. ex Lam. Dict. Encycl. Bot. 1:349. 1783.
Resinaria Comm. ex Lam., loc. cit. 1783.
Chuncoa Pav. ex Juss. Gen. Pl. 76. 1789.
Badamia Gaertn. Fruct. 2:90. *t. 97, fig. 1*. 1791.
Myrobalanus Gaertn. loc. cit. *fig. 2*. 1791.
Catappa Gaertn. loc. cit. 206. *t. 127*. 1791.
Gimbernatea Ruiz & Pav. Prodr. 138. *t. 36*. 1794.
Fatraea Juss. in Ann. Mus. Par. 5:223. 1804.
Pentaptera Roxb. [Hort. Beng. 34. 1814 nom. nud.] Fl. Ind. 2:437. 1832.
Vicentia Allem. Pl. Nov. Bras. *cum tab.* 1844.
Chichharronia A. Rich. Ess. Fl. Cub. 529. *t. 43*. 1845.

Trees, sometimes of great stature, frequently buttressed, rarely shrubs, branching often sympodial. Leaves usually spirally arranged, often crowded in pseudowhorls at the ends of the branchlets, usually petiolate, entire, often minutely verruculose and pellucid-punctate, often with domatia, frequently with two or more glands at or near the base of the lamina or on the petiole. Flowers actinomorphic, 5-merous (rarely 4-merous) usually in axillary spikes with staminate flowers towards the apex and perfect flowers towards the base of the spike, or all perfect, more rarely in terminal or terminal and axillary panicles; staminate flowers stalked, stalks resembling pedicels but equivalent to the lower receptacle with abortion of the ovary; perfect sessile. Receptacle divided into a lower part (lower receptacle) enclosing and adnate to the ovary and often narrowed above it, and an upper part, often scarcely developed, expanded into a shallow cup terminating in the calyx-lobes. Calyx-lobes deltoid, ovate or triangular. Petals absent. Stamens usually 10, exserted; anthers dorsifixed, versatile. Disk intra-staminal, usually pilose or barbate, sometimes glabrous or poorly developed. Style simple, free, exserted. Ovary completely inferior, unilocular with 2 (rarely 3–4) pendulous

Fig. 47. *Terminalia chiriquensis*

ovules of which only one develops. Fruit (pseudocarp) very variable in size and shape, often fleshy and drupe-like, sometimes dry and leathery or corky, often 2- to 5-winged, usually with the endocarp at least partially sclerenchymatous (thus distinguishing it from *Combretum*).

About 200 species throughout the tropics.

In addition to the two species listed below, *T. catappa* L., an Asiatic and Polynesian species with large obovate leaves and drupaceous fruits, is commonly planted.

a. Leaves obovate and abruptly acuminate. Fruit 5-winged, two wings transversely elongated and much longer than the others..... 1. T. AMAZONIA
aa. Leaves elliptic. Fruit with 2 broad lateral and 1 inconspicuous carinate adaxial wings..... 2. T. CHIRIQUENSIS

1. TERMINALIA AMAZONIA (J. F. Gmel.) Exell, in Pulle, Fl. Surin. 3:173. 1935.

Chuncoa amazonia J. F. Gmel. in L. Syst. Nat. 2:702. 1791.
Gimbernatea obovata Ruiz & Pav. Fl. Peruv. Chil. Prodr. 138. 1794.
Chunchoa obovata (Ruiz & Pav.) Pers. Syn. 1:486. 1805.
Chuncoa obovata (Ruiz & Pav.) Poir. in Encycl. Méth. Bot., Suppl. 2:258. 1811.
Terminalia obovata (Ruiz & Pav.) Steud. Nomencl. Bot. 2:668. 1841, non *T. obovata* Cambess. (1829).
Terminalia odontoptera Heurck & Müll. Arg. Obs. Bot. 217. 1870.
Myrobalanus obovatus (Ruiz & Pav.) O. Kuntze, Rev. Gen. 237. 1891.
Terminalia hayesii Pittier, in Contrib. U. S. Nat. Herb. 18:239. 1917.

Large tree up to 30 m. high with buttresses and sympodial branching. Branchlets rufous-pilose or rufous-sericeous, soon glabrescent. Leaves chartaceous to subcoriaceous, spirally arranged in pseudo-verticels at the ends of the branchlets, petiolate, petiole 1–10 mm. long, rufous-pubescent, lamina obovate or cuneate, abruptly acuminate at the apex, cuneate at the base usually with two glands, 5–10 × 3.5 cm., usually rather sparsely appressed-pubescent or appressed-pilose with hairy domatia in the axils of the principal veins beneath. Flowers white, cream or yellowish-green, apparently all perfect, 5-merous, sessile, in axillary spikes 6–7 cm. long, rhachis tomentellous. Lower receptacle 2–2.5 mm. long, sericeous; upper receptacle shallow-cupuliform, 0.8 × 2 mm., appressed-pubescent. Calyx-lobes deltoid, 0.8 mm. long, usually not reflexed. Stamens 10, filaments 1.8–2 mm. long, anthers subglobose, 0.4 mm. in diam. Disk densely pilose. Style 2 mm. long, glabrous. Fruit about 5 × 10 mm., sparsely pubescent, 5-winged, two wings transversely elongated to about 5 mm., the other three usually rudimentary (or vestigial) not more than 1 mm. in width.

From Mexico to Guiana, Trinidad, Brazil and Peru. The wood is said to be very hard and of good quality.

CANAL ZONE: Victoria Fill, near Miraflores Lock, *Allen 1754*; Paraíso Station, *Hayes 718*, s. n. PANAMÁ: near Cerro Jefe, alt. 600 m., *Allen 3436*.

In most American botanical works this species is called *Terminalia obovata* (Ruiz & Pav.) Steud (1841) but this name is preoccupied by *T. obovata* Cambess. (1829). The epithet is also antedated by *Chuncoa amazonia* J. F. Gmel.

2. TERMINALIA CHIRIQUENSIS Pittier, in Contrib. U. S. Nat. Herb. 18:238. 1917.

Tree up to 30 m. tall. Branchlets rufous-sericeous when young, soon glabres-

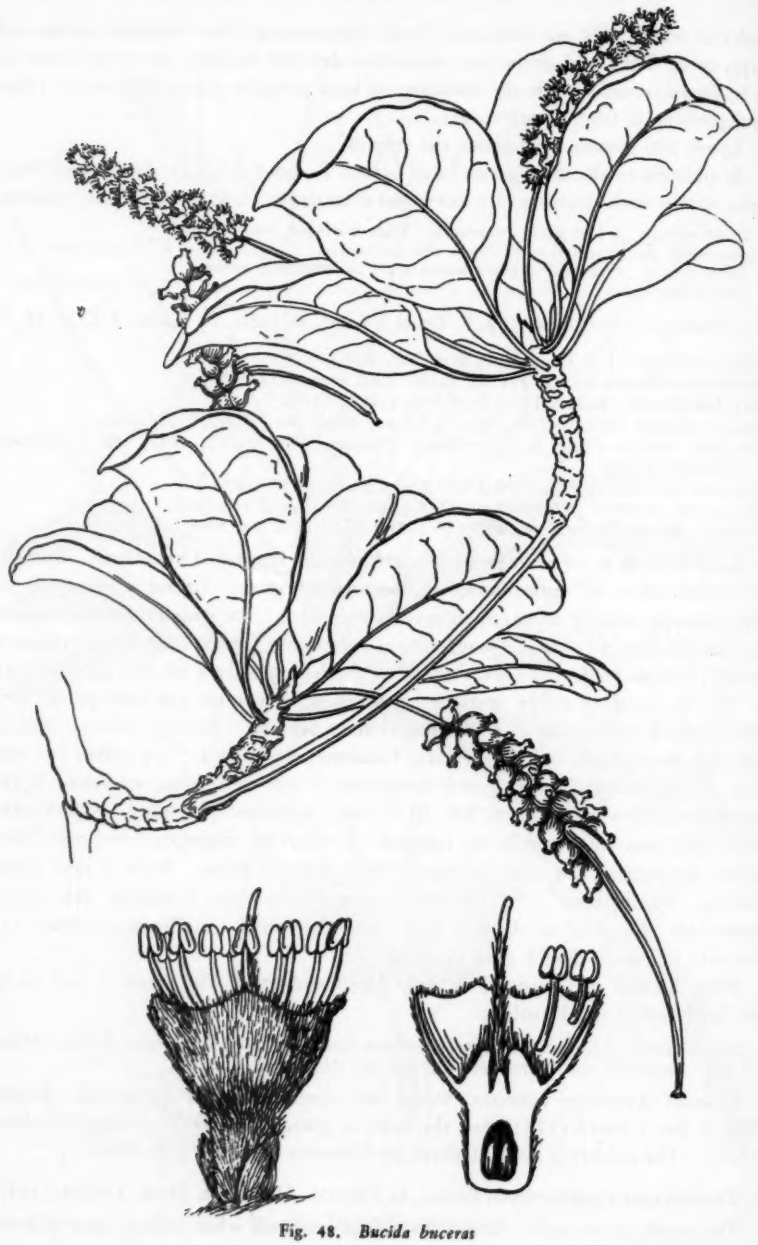

Fig. 48. *Bucida buceras*

cent. Leaves spirally arranged, often pseudo-whorled at the ends of the branchlets, membranaceous to chartaceous, petiolate, petiole 2–18 mm. long, rufous-sericeous when young, lamina elliptic, 10–18 × 4–6 cm., rufous-sericeous when young and retaining some pubescence on the nerves when adult, otherwise nearly glabrous, minutely verruculose above, pellucid-punctate at least in some stages, acuminate at the apex, cuneate at the base. Flowers yellowish-green, sessile, apparently all perfect, in axillary spikes 8–11 cm. Fruit transversely oval, about 1.5–2.0 × 2.5–3.5 cm., pale greenish yellow, glabrous, subsessile, samaroid, 3-winged, the 2 lateral very broad and pronounced, about 1.5 cm. wide, the 1 adaxial merely carinate and less than 1 mm. wide.

Panama, Costa Rica.

BOCAS DEL TORO: Almirante, *Cooper & Slater 55, Seibert 1534.*

The description of the fruit is taken from *Skutch 4252* (MO), collected in the vicinity of El General, Prov. San José, Costa Rica, the flowering companion sheet of which (*Skutch 3990*, MO) agrees well with *Seibert 1534* (MO).

3. BUCIDA L.

BUCIDA L. Syst. Nat. 2:1025. 1759, nom conserv.

Buceras P. Br. Hist. Jam. *t. 23.* 1756, nom rejic.

Trees. Leaves spirally arranged, usually pseudo-whorled. Upper receptacle remaining attached to the fruit and calyx-lobes scarcely developed. Fruit not winged, slightly oblique. Other characters as in *Terminalia.*

Two or three species from Florida, Central America, Guiana (*fide* Pulle) and in the West Indies.

Grounds for separating this genus from *Terminalia* are slender; Bentham and Hooker and a few other authors have not maintained it. The apparently excellent character of the persistent upper receptacle suffices adequately to distinguish the two genera in the New World but one or two Malayan-Polynesian species of *Terminalia*, quite unrelated to *Bucida*, show the same feature. There seems, however, no grave disadvantage in maintaining the status quo.

1. BUCIDA BUCERAS L. Syst. Nat. 2:1025. 1759.

Buceras bucida Crantz, Inst. Rei Herb. 1:133. 1766.
Terminalia buceras (L.) Wright, in Sauv. Fl. Cub. 38. 1868.
Myrobalanus buceras (L.) O. Kuntze, Rev. Gen. 237. 1891.

Medium-sized tree, 5–20 m. high. Branchlets at first sericeous, sometimes spiny (but apparently rarely in Panama); growth sympodial. Leaves coriaceous, pseudo-whorled at the tips of the branchlets, shortly petiolate, petiole 2–10 mm. long, sericeous, eventually glabrescent, lamina elliptic, narrowly elliptic or obovate-elliptic, 2–9 × 1–4 cm., pilose-sericeous when young, later appressed-pilose, appressed-pubescent or nearly glabrous, blunt or rounded at the apex, cuneate at the base and often with two not very conspicuous glands. Flowers pale green (or

Fig. 49. *Buchenavia capitata*

violet?), 5-merous, sessile, mostly perfect, in axillary spikes 2–8 cm. long, rhachis appressed-pubescent. Lower receptacle 1–1.5 mm. long, sericeous-tomentose; upper receptacle shallow-cupuliform, 1 × 2.5 mm., appressed-pubescent, persistent. Calyx-lobes little developed. Stamens 10, filaments 4 mm. long, anthers 1 mm. long. Disk 5-lobed, round the base of the style. Style 3.5 mm. long, glabrous. Fruit ovoid or pyriform, up to 4–6 × 2.5–4.5 mm., slightly and somewhat unequally 5-lobed, often slightly contorted, not winged, densely appressed-pubescent, crowned by the persistent upper receptacle (calyx), often galled.

Florida to Guiana (*fide* Pulle) and in the West Indies.

BOCAS DEL TORO: southwest of Bocas at Macaw Hill, *Von Wedel 557*; vicinity of Chiriquí Lagoon, Isla Colón, *Von Wedel 2929*. CANAL ZONE: Aspinwall, *Hayes 24, s. n.*

This species is very variable in size and shape of leaf and presence or absence of spines. As far as can be judged from the small amount of material seen, it is mainly the larger-leaved spineless form which occurs in Panama. In the West Indies forms with very much smaller leaves and well developed spines occur and *Bucida spinosa* Jennings (*Terminalia spinosa* Northrop, non Engl.) from the Bahamas, with leaves only about 1 cm. long and numerous spines, has been separated as a distinct species. The sterile specimen *Von Wedel 557* from Macaw Hill has narrow leaves and one or two spines. It is described, possibly erroneously, as having violet flowers.

The timber is said to be useful.

4. BUCHENAVIA Eichl.

BUCHENAVIA Eichl. in Flora 49:164. 1866.

Hudsonia A. Robinson, ex Lunan, Hist. Jam. 2:310. 1814, not L. (1767).

Trees or shrubs. Leaves alternate or pseudo-whorled. Flowers 5-merous, perfect and staminate together in elongated or subcapitate axillary spikes. Petals absent. Stamens 10, anthers adnate to the filaments, immobile. Fruit fleshy, 5-ridged or 5-angled, endocarp sclerenchymatous.

12–15 species, throughout tropical America.

1. BUCHENAVIA CAPITATA (Vahl) Eichl. in Flora 49:164. 1866.

Bucida capitata Vahl, Eclog. Amer. 1:50. *t. 8, fig. 1.* 1796.
Hudsonia arborea A. Robinson, ex Lunan, Hist. Jam. 2:310. 1814.
Terminalia obovata Cambess. in St.-Hil. Juss. & Cambess. Fl. Bras. Merid. 2:241. 1829.
Terminalia hilariana Steud. Nomencl. Bot. 2:668. 1841.

Tree of about 8 m., branchlets rufous-tomentose when very young, soon glabrescent; growth sympodial. Leaves pseudo-whorled at the tips of the branchlets, chartaceous to subcoriaceous, petiolate or subsessile, petiole up to about 6 mm. long, rufous-pilose at first, later glabrescent, lamina obovate-cuneate, usually rounded at the apex and decurrent into the petiole, 2–9 × 1–3.5 cm., tomentose when young becoming glabrous. Flowers mostly perfect, 5-merous, sessile, in subcapitate spikes, peduncles 1.5–7 cm. long, rufous-tomentose when young, glabrescent. Lower receptacle 1–3 mm. long, narrowed and slightly twisted at the apex,

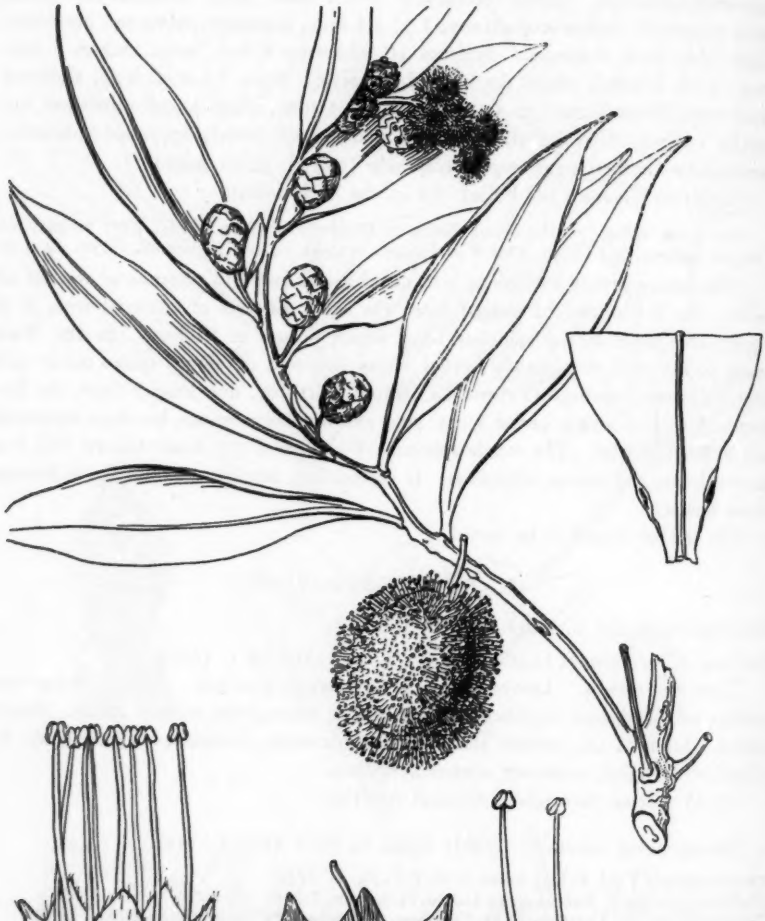

Fig. 50. *Conocarpus erectus*

densely sericeous; upper receptacle shallow-cupuliform, 1 × 2.5 mm., sparsely pubescent or nearly glabrous. Calyx-lobes obsolete. Petals absent. Stamens 10, biseriate, filaments about 2 mm. long, anthers about 0.6 mm. long, adnate to the filaments. Disk patelliform with a free, densely pilose margin. Style subulate, 3.5 mm. long, glabrous. Fruit greenish-yellow (black when dried), ellipsoid, somewhat flattened, more or less 5-ridged, 2–3 × 1–1.5 cm., mesocarp fleshy, endocarp hard and stony.

Panama to Bolivia and northern Brazil, and in the West Indies.

PANAMÁ: Río La Maestra, 0–25 m. alt., *Allen 35*.

5. CONOCARPUS L.

CONOCARPUS L. Sp. Pl. 1:176. 1753; Gen. Pl. 81. 1754.

Rudbeckia Houst. ex L. loc. cit. 1754, in syn. non L. (1753).
Rudbeckia Adans. Fam. 2:80, 599. 1763, nom. illegit. non L.

Small trees or shrubs, erect or prostrate. Leaves alternate. Flowers sessile, 5-merous, perfect and staminate in the same inflorescences, densely aggregate into pseudo-capitula. Petals absent. Stamens usually 10, sometimes fewer by abortion, anthers dorsifixed, versatile. Disk intrastaminal. Ovules 2, pendulous. Fruits (pseudocarps) laterally compressed, 2-winged, densely aggregated in a cone-like mass.

A genus consisting of two littoral species, often constituents of mangrove swamps, one in tropical and subtropical America and Africa, the other in Somaliland and Arabia.

1. CONOCARPUS ERECTUS L., Sp. Pl. 1:176. 1753, Var. ERECTUS.

Conocarpus procumbens L. loc. cit. 177. 1753.
Conocarpus supinus Crantz, Inst. Rei Herb. 1:355. 1766.
Conocarpus acutifolius Humb. & Bonpl. ex Roem. & Schult. in L. Syst. Veg. 5:574. 1819.
Conocarpus erectus var. *arboreus* et *procumbens* DC. Prodr. 3:16. 1828.
Conocarpus pubescens Schumach. in Kongel. Dansk. Vid. Selsk. Naturvid. & Math. Afh. 3:135. 1828.
Terminalia erecta (L.) Baill. Hist. Pl. 6:266, 275. *fig. 240*. 1877.

This has been placed under var. *erectus* for nomenclatural reasons, not with any intention of considering that the erect form differs from the prostrate form but because var. *sericeus* (not occurring in Panama) may be a distinct taxon.

Small tree up to about 8 m. high, sometimes sprawling or procumbent, with stilt-roots and flattened, slightly winged branchlets, usually appressed-pubescent at first, soon glabrescent. Leaves alternate, shortly petiolate or subsessile, petiole up to 4 mm. long, pubescent or glabrous with two prominent glands near the apex or at the base of the lamina, papyraceous, chartaceous or subcoriaceous, somewhat fleshy, lamina narrowly elliptic, up to 11 × 3.5 cm., often much smaller, usually glabrous, rarely very sparsely pubescent, acute and slightly acuminate at the apex, cuneate at the base and often decurrent into the petiole; midrib fairly prominent on the under surface, lateral nerves and reticulation rather inconspicuous. Flowers

greenish-white, in the axils of small ovate or lanceolate ciliate bracts, aggregated in subglobose capitula, 3–5 mm. in diam., with sericeous peduncles 5–15 mm. long, forming a terminal panicle and capitula also sometimes solitary in the axils of the upper leaves. Lower receptacle (ovary) 1 mm. long, sericeous; upper receptacle (calyx) cupuliform, 1 × 1.5 mm., nearly glabrous, with lobes 0.5 mm. long. Stamens normally 10, biseriate, filaments 1.5–2 mm. long, anthers 0.5 mm. long. Disk pilose. Style 2 mm. long. Fruits squamiform, 3 × 3–3.5 mm., somewhat sericeous, recurved at the apex and often bearing the remains of the calyx, imbricated in a subglobose or cone-shaped structure, 1–1.5 × 0.7–1.3 cm.

Tropical and subtropical America and Africa.

BOCAS DEL TORO: Isla Colón, *Von Wedel 500*; Old Bank Island, *Von Wedel 2037*; Careening Cay, Chiriquí Lagoon, *Von Wedel 2813*. CANAL ZONE: without precise locality, *Allen 1725*. CHIRIQUÍ: San Bartolomé, Península de Burica, 0.5 m., *Woodson & Schery 938*. PANAMÁ: salt-marshes, *Barclay 2512*; Perlas Archipelago, San José Island, *Johnston 339*; vicinity of Bejuco, edge of mangrove-swamp, *Woodson, Allen & Seibert 1683*.

6. LAGUNCULARIA Gaertn. f.

LAGUNCULARIA Gaertn. f. in Gaertn. Fruct. 3:209. *t. 217*. 1807.

Horau Adans. Fam. 2:80, 585. 1763.
Sphenocarpus Rich. Demonstr. Bot. 92. 1808.
Rhizaeris Raf. Sylv. Tellur. 90. 1838.

The name *Laguncularia* Gaertn. f. is antedated by *Horau* Adans. and should be conserved.

Small trees and shrubs. Flowers sessile, 5-merous, mostly perfect with occasional staminate in terminal panicles of elongated spikes with additional spikes in the axils of the upper leaves. Receptacle infundibuliform, scarcely produced beyond the ovary, with 2 small adnate bracteoles near the apex and crowned with the persistent calyx. Petals 5, small. Stamens 10, biseriate, not exserted. Disk 10-rayed. Style subulate, capitate at the apex. Ovary unilocular with 2 pendulous ovules. Fruit almost sessile, longitudinally ribbed or narrowly winged, pericarp leathery.

A genus comprising one or perhaps two species inhabiting mangrove-swamps in tropical America and western tropical Africa and often dominant in such habitats.

1. LAGUNCULARIA RACEMOSA (L.) Gaertn. f. in Gaertn. Fruct. 3:209. *t. 217*. 1807.

Conocarpus racemosus L. Syst. Nat. 2:930. 1759.
Schousboa commutata Spreng. Syst. Veg. 2:332. 1825, nom. illegit.
Rhizaeris alba Raf. Sylv. Tellur. 90. 1838, nom. illegit.
Laguncularia obovata Miq. in Linnaea 18:752. 1844.

Small tree up to about 10 m. high or bush, with glabrous branchlets usually chestnut-brown when dried, slightly swollen at the nodes. Leaves opposite, decussate, petiolate, petiole 1–1.5 cm. long, glabrous, with two conspicuous glands 2–4 mm. below the apex, lamina chartaceous to subcoriaceous, elliptic or oblong-elliptic,

Fig. 51. *Laguncularia racemosa*

up to 10 × 5.5 cm., glabrous, usually blunt or rounded at the apex and slightly rounded at the base, lateral nerves rather numerous but inconspicuous, reticulation just visible. Flowers white or greenish-white, sessile, 5-merous, in terminal panicles up to about 20 cm. long of elongated spikes up to 7–8 cm. long, rhachis densely appressed-pubescent, bracts suborbicular to ovate, pubescent, 1.5 × 1.3 mm., soon caducous. Receptacle infundibuliform, elongating as the fruit develops, tomentellous, 2.5 × 1.5 mm., with two small obversely elliptic bracteoles, 1.5 × 2 mm., near the apex, expanded at the apex into a persistent cupuliform calyx with 5 broad lobes, imbricate in bud. Petals 5, suborbicular, appressed-pubescent. Stamens 10, filaments very short, inflexed in bud, inserted near the margin of the disk. Disk fleshy, 10-rayed. Style 1 mm. long, glabrous, stigma capitate. Fruit flattened-obovoid-ellipsoid, at first densely later sparsely appressed-pubescent, 12–20 × 6–10 mm. when mature, more or less longitudinally winged or ribbed, wing up to 2 mm. broad but usually less than 1 mm., crowned by the persistent remains of the calyx.

Florida to Peru and Brazil, also in West Indies, Galapagos Islands and Fernando do Noronha; in western tropical Africa from Senegal to Angola.

BOCAS DEL TORO: Perlas Islands, Trapiche, growing as isolated specimens on rocky beaches, *Allen 2616*; Isla Colón, southwest of Bocas, Macaw Hills, *Von Wedel 522*; Chiriquí Lagoon, *Von Wedel 1061*; vicinity of Chiriquí Lagoon, Nances Cay, *Von Wedel 2861, 2937*; CANAL ZONE: between Panamá and Corozal, alt. 20–30 m., *Pittier 4441*; banks of Río Grande, growing in mud, *Woodson, Allen & Seibert 763*. CHIRIQUÍ: San Bartolomé, Península de Burica, *Woodson & Schery 936*. PANAMÁ: Isla Taboga, 0–186 m., on rocky coast, *Woodson, Allen & Seibert 1534*.

I have seen specimens with glabrous flowers and fruits from southwest Florida (*Rugel 239*) and Cuba (*Jack 5255*) but not, as yet, from Panama. These may well be *Laguncularia glabriflora* Presl (Reliq. Haenk 2:22. 1831) though the latter was described as having red flowers (perhaps erroneously). The type is from Guayaquil. It would be interesting to study populations of *L. racemosa* to see whether glabrous-flowered plants occur. As far as the present meagre evidence goes it would seem that *L. glabriflora* could be treated as a glabrous variety of *L. racemosa* but without any well-marked geographical distribution.

MYRTACEAE

By G. J. H. AMSHOFF

Shrubs or trees with bicollateral vascular tissue and intraxylary phloem. Leaves opposite, rarely subalternate, simple, entire or at most crenulate, pellucid-punctate, these aromatic glands usually present also in other parts of the plant; stipules usually wanting. Inflorescence racemose or cymose, often paniculate, axillary or subterminal in the axils of the upper leaves before the development of the terminal bud or rarely truly terminal. Flowers 4- or 5-merous, hermaphrodite, regular, subtended by two opposite bracteoles. Sepals either free and usually imbricate in the bud or concrescent, calyptriform and circumscissile from the base at anthesis. Petals 4 or 5, rarely minute or wanting. Stamens usually numerous, inserted on the margin of the receptacle in 1 to several series; filaments incurved in the bud, rarely straight, often conspicuous by their length and color or at least by their number; anthers dorsifixed, rarely basifixed, 2-celled as a rule, dehiscing longitudinally, the connective usually terminating in a gland, the pollen trigonous, 3-porous. Ovary inferior, rarely subinferior, 2- to several-celled, the receptacle often produced above; placenta mostly axile; ovules 2 to several in each cell; style simple, filiform, the stigma small. Fruit a berry or a drupe or, in some Asiatic and Australian genera often cultivated in other countries, a loculicidal capsule; seeds without endosperm, the embryo straight or incurved with free or connate cotyledons (in the first case the radicle also free and the cotyledons either foliaceous and contort-plicate or thick and plano-convex).

Distribution: Species about 3000, chiefly in the tropics and in Australia. In Europe only *Myrtus communis*. The Central American genera fall into three subtribes.

A. Cotyledons free, foliaceous, more or less contort-plicate; radicle elongate, about as long as the cotyledons. Flowers mostly 5-merous, paniculate; ovary 2- to 3-celled, the ovules 2 in each cell. Berry mostly 1- or 2-seeded. (Subtribe MYRCIINAE)

1a. Calyx concrescent, at anthesis circumscissile and falling away like a lid, remaining attached at one point, at last quite deciduous. Indumentum often formed by dibrachiate hairs ..... 1. CALYPTRANTHES

b. Sepals free, imbricate in the bud. Hairs simple 2

2a. Receptacle cup-like, produced above the ovary; berry globose ..... 2. AULOMYRCIA

b. Receptacle not produced above the ovary; berry usually ellipsoid or oblong ..... 3. MYRCIA

B. Embryo straight, either homogeneous (the cotyledons and radicle connate) or with free plano-convex cotyledons and short radicle. Flowers mostly 4-merous, in more or less abbreviated racemes, often glomerate, rarely solitary or cymose; ovary 2(–3)-celled, the ovules 2 to several in each cell. Berry mostly 1-seeded, sometimes several-seeded. (Subtribe EUGENIINAE)

1a. Inflorescence cymose; flowers large, the expanded cluster of stamens 2 cm. or more in diameter ..... 4. SYZYGIUM

b. Inflorescences glomerate or racemose, rarely solitary or cymose; flowers small, the expanded cluster of stamens less than 1 cm. in diameter 2

2a. Receptacle produced above the ovary, circumscissile at base. Ovules 2 or 4, ascending, in each cell of the ovary. Flowers glomerate ..... 5. MYRCIARIA

b. Receptacle not produced above the ovary. Ovules usually more than 2 in each cell of the ovary. Flowers in racemes, fascicles or glomerules, rarely solitary or cymose..... 6. EUGENIA

C. Embryo incurved, the radicle elongate, much longer than the minute cotyledons. Inflorescence usually 1- to 7-flowered and cymose on a long peduncle (or pedicel if flowers solitary). Ovary 2- to 7-celled; ovules several to numerous in each cell. Seeds mostly numerous, small. (Subtribe MYRTINAE)

1a. Bud closed, sepals not reflexed or spreading until anthesis..... 9. PSIDIUM

b. Bud open, sepals reflexed or spreading before anthesis.....2

2a. Filaments incurved in the bud, filiform; anthers dorsifixed. Leaves mediocre..... 7. CALYCOLPUS

b. Filaments straight or nearly so in the bud, flattened; anthers basifixed. Leaves very small..... 8. UGNI

In a recent publication by E. Kausel (in Ark. Bot. n. s. 3:491–516. 1956) the following information of systematic importance concerning the germination of the seed is given:

Myrcioideae (in Panama—*Myrcia, Aulomyrcia* and *Calyptranthes*): Germination epigaeous, the large foliaceous, contort-plicate, ensheathing cotyledons become the first assimilating leaves of the young seedling.

Myrtoideae (in Panama—*Ugni, Calycolpus* and *Psidium*): Germination epigaeous, the cotyledons very small.

Eugenioideae (in Panama—*Eugenia* and *Myrciaria*): Germination hypogaeous, the cotyledons remaining in the seed under the ground.

Beside the genera enumerated in the key, representatives of the Australian genera *Melaleuca* and *Eucalyptus* are cultivated in Panama. *Melaleuca leucodendron* L. is an ornamental shrub or small tree with narrowly lanceolate, alternate leaves with conspicuous longitudinal nerves and flowers in terminal spikes. It is cultivated in the Plant Introduction Garden at Summit, Canal Zone, and probably elsewhere.

The most frequently cultivated species of *Eucalyptus* is *E. globulus* Labill. planted as a shade tree. *Pimenta officinalis*, the Allspice, is planted in various parts of temperate and hot regions of tropical America, but has not yet been reported from Panama.

1. CALYPTRANTHES Sw.

CALYPTRANTHES Sw. Prodr. Veg. Ind. Occ. 79. 1788, nomen conservandum.

Chytraculia P. Br. Hist. Jam. 239. 1756.
Chytralia Adans. Fam. 2:80. 1763.
Suzygium P. Br. ex Adans. loc. cit. 244. 1763.
Calypthranthes Raeuschel, Nom. ed. 3. 144. 1797.
Calyptranthus Juss. Dict. Sci. Nat. 6:274. 1817.

Shrubs or trees, the indument if present partly or entirely composed of dibrachiate hairs. Inflorescence cymose-paniculate, several-flowered, rarely only 3-flowered, usually subterminal. Receptacle distinctly produced above the ovary. Calyx concrescent, circumscissile at anthesis but the calyptra remaining attached at one point. Petals minute or wanting. Stamens numerous, incurved in the bud; anthers ovate, 2-celled, dorsifixed, opening by longitudinal slits. Ovary 2- to

3-celled; cells 2-ovulate, the ovules ascending; stigma simple. Berry globose, crowned by the persistent free margin of the receptacle, 1- to 2-seeded, cotyledons free, contort-plicate, the radicle elongate.

Distribution: Species about 70 in tropical and subtropical America.

1a. Inflorescence 1- to 3-flowered, on a long slender peduncle ..... 3. C. HYLOBATES
b. Inflorescence cymose-paniculate, several- or many-flowered 2
1a. Leaves large 12–28 cm. long; flower buds globose, about 2.5 mm. high. 1. C. TUMIDONODIA
b. Leaves much smaller, less than 15 cm. long 3
3a. Inflorescence and flower buds pubescent 4
b. Inflorescence and flower buds quite glabrous, the ultimate flowers not more than 3 together, mostly pedicellate ..... 2. C. SCHIEDEANA
4a. Ultimate flowers glomerate, sessile, up to 5 together; inflorescence shortly villous with stalked hairs ..... 4. C. CHYTRACULIA
b. Ultimate flowers partly pedicellate, usually not more than 3 together; inflorescence finely sericeous with sessile hairs ..... 5. C. COSTARICENSIS

Calyptranthes pittieri Standl. also recorded from Panama, but which I have not seen, seems to be characterized by its thick and coriaceous leaves less than 10 cm. long, and pubescent cymose-paniculate inflorescence with sericeous flower buds about 3.5 mm. long.

1. CALYPTRANTHES TUMIDONODIA Schery, in Ann. Missouri Bot. Gard. 30:215. 1943.

Calyptranthes urophylla Standl. & Williams, in Ceiba 3:215. 1953.

Shrubs about 2.5 m. high, or small trees, nearly glabrous. Twigs terete, with thickened nodes. Leaves elliptical or elliptical-oblong, long acuminate at the apex, acute at the base, glabrous above, sparsely pubescent or glabrate beneath, 12–28 cm. long and 5–9 cm. wide, membranaceous, the midrib impressed above, prominent beneath, the lateral nerves in about 25 pairs, slender, inconspicuous on both sides, the marginal nerve at about 2–3 mm. distant from the margin; petiole about 8 mm. long, thick, canaliculate. Inflorescence cymose-paniculate, about 9 cm. long, terminal and in the upper axils, lax and many-flowered, brown-pubescent with sessile dibrachiate hairs. Flower buds brown-pubescent, about 3 mm. high. Flowers whitish. Endemic. In the original description of *C. tumidonodia* both specimens of Von Wedel are cited. *Von Wedel 2195* was afterwards, apparently in haste, redescribed as *C. urophylla*.

BOCAS DEL TORO: Fish Creek hills, *Von Wedel 2195, 2223*.

2. CALYPTRANTHES SCHIEDEANA Berg, in Linnaea 27:28. 1855.

Myrcia aromatica Schlechtend. loc. cit. 13:415. 1839, non *Calyptranthes aromatica* St. Hil. (1828).
Calyptranthes schlechtendaliana Berg. loc. cit. 27:29. 1855.

Trees or shrubs, glabrous throughout, the twigs slender, subterete. Leaves petiolate, broadly elliptical to lanceolate- oblong, 4.0–7.5 cm. long and 2.0–4.5 cm. wide, acute or obtuse at the base, acuminate at the apex, chartaceous, the midrib impressed above, prominent beneath, the lateral nerves numerous, prominent on both sides, joining the marginal nerve near the margin; petiole about 4 mm. long. Inflorescence paniculate, many-flowered, about as long as the leaf, the ultimate

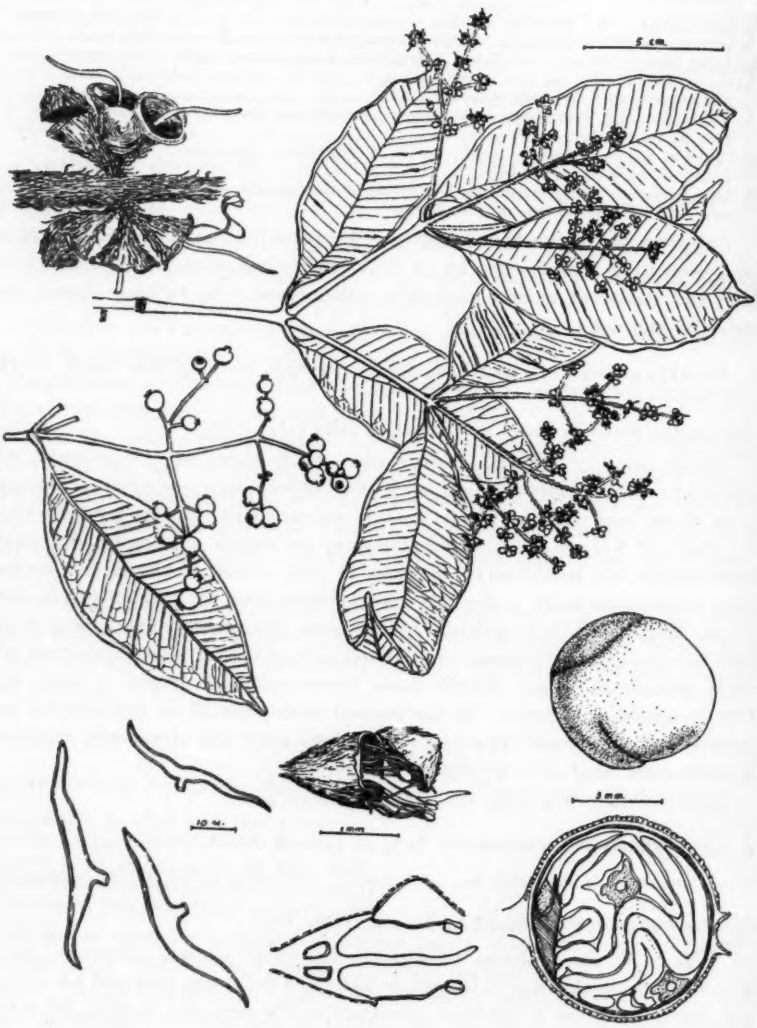

Fig. 52. *Calyptranthes chytraculia*

flowers sometimes 3 together, sessile, but for the greater part pedicellate. Flower buds globose, glabrous, 1.5–2.0 mm. high. Fruit globose, 4–6 mm. in diameter.

Mexico and Panama. Originally described from Mexico and quite common in that country.

PANAMÁ: Taboga Island, *Barclay s. n.* VERAGUAS: Coiba Island, *Seemann 624.*

3. CALYPTRANTHES **hylobates** Standl. spec. nov. ined. in herb.

Arbores parvae ca. 8 m. altae trunco ca. 10 cm. diam. ramulis gracilibus multo divisis apice quadrangularibus vel anguste alatis glabris. Folia oblonga membranacea glabra basi acuta apice longe acuminata 5–7 cm. longa 2.0–2.5 cm. lata nervo medio supra impresso subtus prominente nervis lateralibus numerosis tenuibus uterque superficieibus prominulis ca. 1 mm. ab margine in nervum marginalem collictis; petiolo brevi ca. 2 mm. longo. Inflorescentia 1- vel 3-flora pedunculo gracili usque 3.5 cm. longo glabro flore centrale sessile sive lateralibus usque 1 cm. longe pedicellatis. Flores adulti ignoti. Bacca globosa ut dicitur fulva; cotyledonibus foliaceis contorto-plicatis.

Panama and Costa Rica.

BOCAS DEL TORO: region of El Almirante, *Cooper 366* (HOLOTYPE, Herb. Chicago Nat. Hist. Mus.).

4. CALYPTRANTHES CHYTRACULIA Sw. Prodr. Veg. Ind. Occ. 79. 1788.

Shrubs or low trees, the young twigs subterete, sparsely pubescent, glabrescent. Leaves elliptical, acute at base, acuminate at apex, glabrous, chartaceous, up to 12 cm. long and 4.5 cm. wide, the midrib impressed above, prominent beneath, the lateral nerves numerous, prominulous on both sides, joining the marginal nerve very near the margin at about 1.5 mm. distance from the margin; petiole canaliculate, up to 8 mm. long, pubescent, glabrescent. Panicles nearly as long as the leaf, rarely shorter, brown-pubescent with dibrachiate stalked hairs, the branches 2–4 together, the ultimate flowers mostly sessile, sometimes partly pedicellate, 1–5 together in small glomerules. Flower buds obovoid, about 2 mm. high, brown-puberulous, opening with a shallow cup-like lid. Petals none. Filaments up to 4 mm. long; anthers small, at length twisted. Berry globose, glabrous; cotyledons contort-plicate.

Yucatan Peninsula, Guatemala and Panama; Jamaica.

BOCAS DEL TORO: Changuinola valley, *Cooper & Slater 143.*

The Panama specimen quite agrees with specimens from British Honduras distributed as *C. millspaughii* Urb. The inflorescence is usually larger than in Urban's description.

5. CALYPTRANTHES COSTARICENSIS Berg, in Linnaea 27:20. 1855.

Trees of 4–7 m., the crown dense and rounded, the branchlets puberulous, compressed. Leaves elliptical, acute at the base, shortly acuminate at the apex, chartaceous, glabrous except the midrib, 6–10 cm. long and 3–5 cm. wide, the

midrib impressed above, prominent beneath, striate-nerved with numerous lateral nerves, these prominulous on both sides and joining the marginal nerve very near the margin; petiole slender, canaliculate, about 5 mm. long. Panicles often longer than the leaf, puberulous with dibrachiate sessile hairs, the branches opposite or ternate, the ultimate flowers at most 3 together, sessile or pedicellate. Anthers 1 mm. long. Flower buds subglobose, about 3 mm. long, puberulous, opening with a petaloid concave lid. Berry globose, about 1 cm. in diameter.

The type specimen collected by Warscewicz "in Costa Rica et Veraguas" has not been seen by us, and apparently no other collections have since been made in Panama. Standley (Fl. Costa Rica 2:770. 1937) feels that the species may be endemic to Costa Rica and reports it as "Common in forests and thickets of the Meseta Central, at 1,100–2,000 meters."

2. AULOMYRCIA Berg

AULOMYRCIA Berg, in Linnaea 27:35. 1855.

Myrcia subgen. *Aulomyrcia* (Berg) Niedenzu, in Engl. & Prantl, Nat. Pflanzenfam. 3[7]:75. 1893.

Shrubs or small trees. Inflorescence paniculate, axillary. Bracts and bractlets small, deciduous. Flowers mostly small, 5-merous or sometimes (not in the Central American species) 4-merous. Flower buds mostly obconic. Receptacle cup-like produced above the ovary, glabrous or pubescent outside, generally glabrous inside. Sepals imbricate, often very unequal, with the inner sepals much larger than the 3 outer sepals. Petals white, orbiculate or obovate. Stamens numerous, inserted on the free margin of the receptacle; filaments incurved in the bud; anthers ovate, dorsifixed, opening by longitudinal slits. Ovary 2- to 3-celled; ovules 2 in each cell, ascending. Berry globose, crowned with the cup-like, persistent, free margin of the receptacle and with persistent sepals, 1- to 3-seeded; cotyledons free, more or less contort-plicate; radicle elongated, inserted near the apex of the embryo.

Distribution: Species about 200 in tropical America. The genus is nearly allied to and often united with *Myrcia* DC. The cup-like produced receptacle of *Aulomyrcia*, a character so useful in distintinguishing other Myrtaceous genera, seems to be the only constant character to distinguish it from *Myrcia*.

1a. Leaves large, up to 30 cm. long..... 1. A. ZETEKIANA
b. Leaves small, 4–6 cm. long..... 2. A. TOMENTOSA

1. AULOMYRCIA zetekiana (Standl.) Amsh. comb. nov.

Eugenia Zetekiana Standl. in Journ. Wash. Acad. Sci. 15:286. 1925.

Shrubs 2.5–4.5 m. high, with few branches, the branchlets densely ferruginous-tomentose. Leaves lanceolate or narrowly oblong-lanceolate, about 30 cm. long, 6.5–9.5 cm. broad, attenuate at apex, rounded at base, coriaceous, glabrous above, tomentose beneath along costa, or glabrate, the venation reticulate, prominent on both sides, the costa stout, the lateral nerves about 20 on each side (young leaves dark purple, glabrous or nearly so); petiole swollen, nearly 1 cm. long. Flowers in

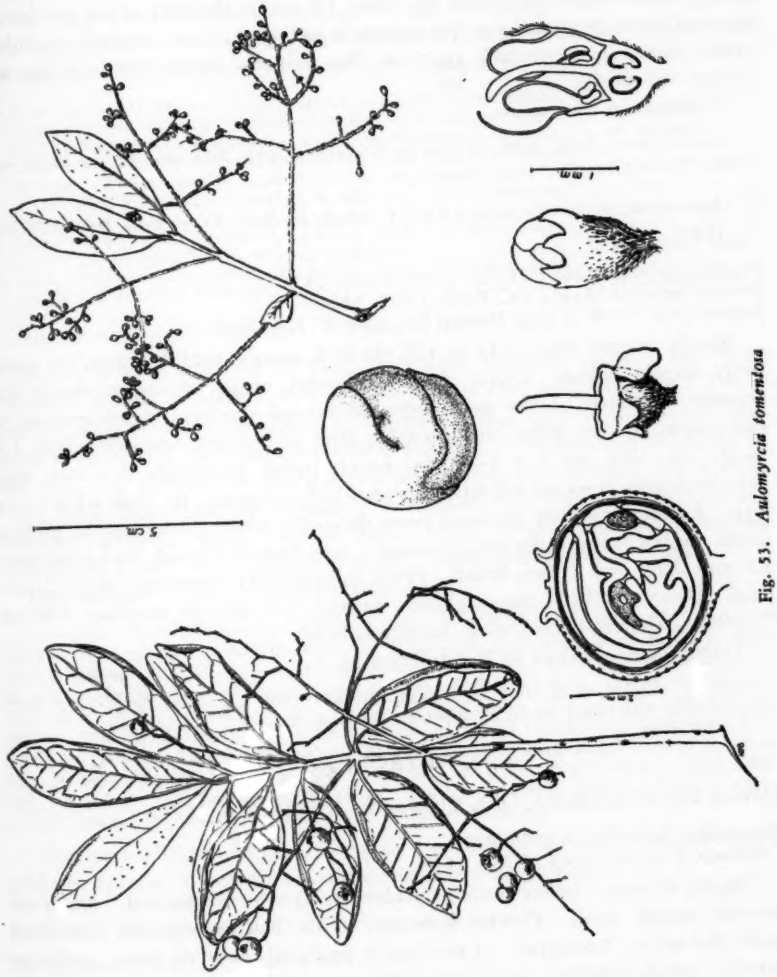

Fig. 53. *Aulomyrcia tomentosa*

terminal, simple or branched racemes 7–8 cm. long, densely velvety-tomentose. Flowers not known. Receptacle produced shortly beyond the ovary, tomentose outside. Sepals 5, subequal, semiorbicular, broadly rounded at apex (the shriveled remains in our specimens about 0.3 mm. long). Petals not seen. Berry globose, densely brown-tomentose, when dry about 1.5 cm. in diameter, green and brown, crowned by the persistent cup-like receptacle and sepals, 1- or 2-seeded. Cotyledons rather thick, plicate; radicle free, less than half the circumference of the seed (about one third).

Endemic, in wet forests.

CANAL ZONE: hills north of Frijoles, *Standley 27503*; hills west of the canal, near Gatún, *Standley 27192*.

2. AULOMYRCIA TOMENTOSA (Aubl.) Amsh. in Rec. Trav. Bot. Néerl. 39:153. 1942.

Eugenia tomentosa Aubl. Pl. Guian. 1:504. *t. 200.* 1775
Myrcia tomentosa (Aubl.) DC. Prodr. 3:245. 1828.
Eugenia vallis Standl. in Ann. Missouri Bot. Gard. 27:323. 1940.

Shrubs or small trees to 12 m. tall, the bark smooth, reddish brown, the young twigs densely villous. Leaves obovate, rounded, retuse, obtuse or shortly and obtusely acuminate at the apex, narrowed toward the base, membranaceous to chartaceous, at first pilose on both sides, later glabrescent especially above, 4–6 (–10) cm. long and 2–4 (–5) cm. broad; petiole pubescent, 2–5 mm. long. Panicles densely flowered, villous. Flowers white, pubescent, the buds 2.0–2.5 mm. high. Receptacle shortly produced above the ovary, white-villous outside, glabrous inside. Sepals unequal, the smallest about 1 mm. long and broad, the largest about 1.5 mm. long and 2 mm. broad. Petals suborbiculate, crenulate, about 2 mm. long. Ovary 2-celled. Berry globose, orange, 5–8 mm. in diameter, 1-seeded. Cotyledons contort-plicate, with elongate radicle.

Distribution: Panama to Brazil; Trinidad.

COCLÉ: vicinity of El Valle de Antón, alt. 600–1000 m., *Allen 1773, 2512, 2578*. PANAMÁ: San José Island, Perlas Archipelago, *Johnston 801, 747, Erlanson 284*.

3. MYRCIA DC.

MYRCIA DC. ex Guillemin, Dict. Class. Hist. Nat. 11:378. 1826.

Aguava Raf. Sylva Tellur. 107. 1838.
Calycampe Berg, in Linnaea 27:129. 1856.

Shrubs or trees. Inflorescence paniculate, axillary or subterminal. Bracts and bractlets mostly small. Flowers 5-merous, in the bud more or less constricted under the calyx. Receptacle not or scarcely produced above the ovary, pubescent outside. Sepals imbricate, equal or slightly unequal. Petals white, orbiculate or obovate, pubescent outside. Stamens numerous; filaments incurved in the bud; anthers ovate, dorsifixed, opening with longitudinal slits. Ovary 2- to 4-celled, terminated by a sericeous disc; ovules 2 in each cell, ascending. Berry 1-seeded, ellipsoid, or 2- to 3-seeded and obovoid or subglobose when ripe, crowned by the

persistent sepals. Seeds with cartilaginous shining testa; cotyledons free, longitudinal (i.e. so placed in the fruit that they are parallel with the greatest length of the fruit), contort-plicate; radicle elongate, half-encircling the embryo.

Distribution: About 100 species in tropical America.

In Panama three rather distinct species can be distinguished. However the genus is badly in need of revision, since the differences are small and in some cases not constant. Four or five other species are known from Central America.

1a. Leaves large, 7–17 cm. long, laxly reticulate, the lateral nerves distant, at last impressed above and prominent beneath; twigs glabrous; flowers relatively large in lax and few-flowered glabrous inflorescences..... 2. M. COUMETA
b. Leaves smaller, usually not more than 10 cm. long, densely reticulate, the lateral nerves prominulous to obsolete above; twigs densely pubescent at least when young; flowers smaller, in dense more or less pubescent inflorescences. 2
2a. Leaves coarsely reticulate-veined, the young twigs and inflorescences more or less densely pubescent with spreading hairs..... 1. M. COSTARICENSIS
b. Leaves finely reticulate-veined, the young twigs and inflorescences sparsely and minutely pubescent..... 3. M. GATUNENSIS

1. MYRCIA COSTARICENSIS Berg, in Linnaea 27:104. 1854.

Shrubs or small trees 2–8 m. high, the crown dense and rounded, the young branchlets densely pubescent with spreading, somewhat brownish hairs. Leaves petiolate, lustrous, lanceolate-oblong or elliptical-oblong, commonly 4–7 cm. long, obtuse or rounded at the base, acuminate at the apex, at first sparsely pubescent on both sides, later glabrate, the lateral nerves prominulous on both sides; petiole about 3 mm. long. Panicles densely pubescent, densely flowered. Flowers white, fragrant. Receptacle sericeous, about 1.5 mm. high. Sepals about 1 mm. long, rounded. Petals about 3 mm. long, pubescent outside. Berry oblong, red to black.

Distribution: Costa Rica and Panama.

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, *Von Wedel 178, 197, 395.* CHIRIQUÍ: valley of the upper Río Chiriquí Viejo, *P. White 191, 337*; vicinity of Boquete, *Allen 4667, Davidson 622, 758*; trail from Bambito to Cerro Punta, *Allen 317*; Finca Lérida to Boquete, *Woodson, Allen & Seibert 1100*; vicinity of Callejón Seco, Volcán de Chiriquí, alt. 1700 m., *Woodson & Schery 497*; vicinity of Bajo Mona and Quebrada Chiquero, alt. 1500 m., *Woodson & Schery 536*; llanos on slopes of Volcán de Chiriquí along Río Chiriquí Viejo, 1200 m., *Allen 1005.* COCLÉ: between Las Margaritas and El Valle, *Woodson, Allen & Seibert 1304*; hills south of El Valle de Antón, alt. about 700 m., *Allen 2519, 2493.* PANAMÁ: Isla Taboga, ca. 0–186 m., *Woodson, Allen & Seibert 1446*; La Chorrera, alt. 200 ft., *Bro. Paul 818.* VERAGUAS: Cañazas, *Allen 163.*

This species, known locally as *arrayán* (myrtle) is the most common *Myrcia* species in Panama, several times collected in nearly all provinces.

2. MYRCIA COUMETA (Aubl.) DC. Prodr. 3:245. 182[illegible].

Eugenia Coumeta Aubl. Pl. Guian. 1:497. *t. 196.* 1775.
Aulomyrcia Coumeta (Aubl.) Berg, in Linnaea 27:60. 1855.

Shrubs or small trees, the twigs almost glabrous. Leaves ovate or ovate-oblong, acute or obtuse at the base, acuminate at the apex, 7–17 cm. long and 4–6 cm. wide, the principal lateral nerves distant, at last impressed above and prominent beneath, the veins laxly reticulate; petiole robust, about 5 mm. long. Panicles

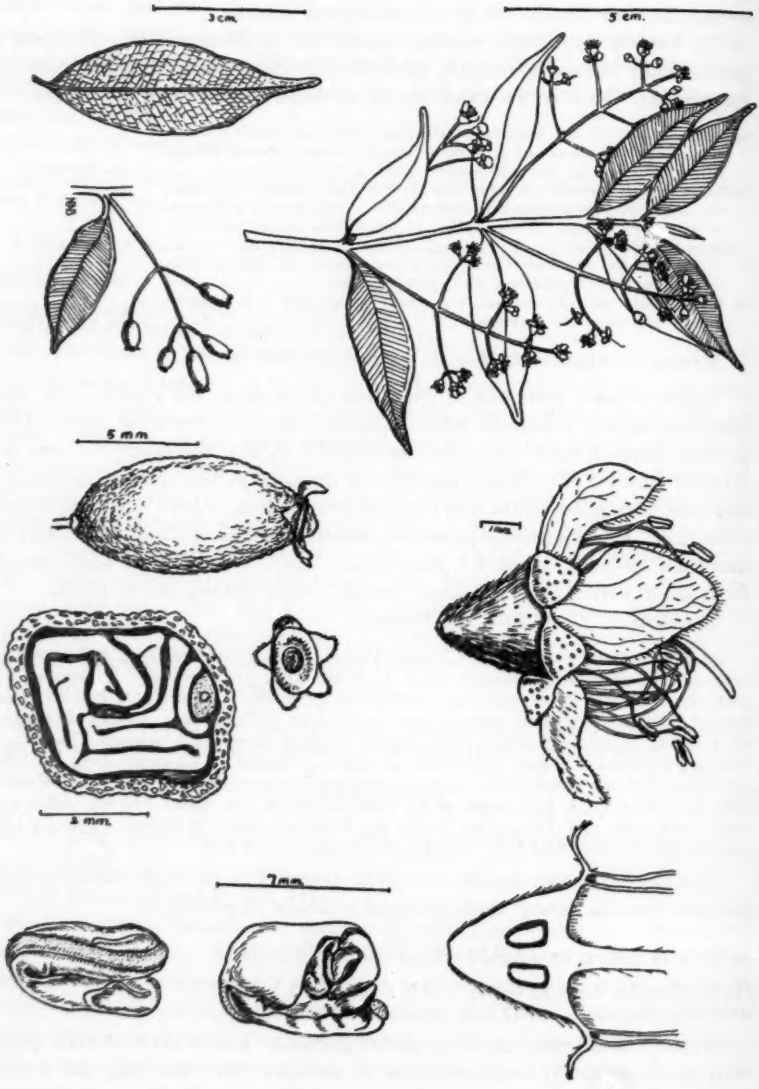

Fig. 54. *Myrcia costaricensis*

nearly glabrous, distantly flowered, with 3–5 pairs of 1- to 9-flowered branches, the pedicels slender, up to 8 mm. long. Flowers larger than in the two other species, the sepals typically up to 2 mm. long, the petals about 4 mm. long. Berry globose in the Panama specimens.

The typical form in French Guiana, Surinam, and also in Costa Rica; the following Panama specimens seem to belong to this species although their fruit is globose instead of oblong and the flowers are not yet fully developed. In Costa Rica the species has been confused with *Myrcia carnea* (Mey.) DC., described from British Guiana but still imperfectly known.

BOCAS DEL TORO: Fish Creek hills, *Von Wedel 2441, 2871, Cooper 570.*

3. MYRCIA GATUNENSIS Standl. in Publ. Field Mus. Bot. 4:154. 1929.

Twigs and inflorescences minutely and finely pubescent. Leaves lanceolate-oblong or elliptical, rounded or obtuse at the base, rather long-acuminate, 7–10 cm. long, chartaceous, the lateral nerves numerous, delicate, prominulous on both sides or obsolete above, the veins densely and finely reticulate, not conspicuous; petioles mostly about 2 mm. long, sometimes longer. Inflorescence slender, shorter than the leaf. Flowers minute, the petals 1.5–2.0 mm. long.

Apparently endemic.

CANAL ZONE: Barro Colorado Island, *Kenoyer 468*; Barro Colorado Island, Barbour Point to next point south, *Bangham 498*; Barro Colorado Island, shores of Gatún Lake, south of Laboratory, *Bangham 451.*

Two other species sometimes are recorded for Panama. The first, *M. oerstedeana* Berg, described from Costa Rica, has leaves similar to those of *M. gatunensis* but is more pubescent; the Panamanian specimens previously referred to that species agree better with *M. costaricensis*. The second, *M. plicato-costata* Berg, is known from Costa Rica, but the record for Panama is dubious. It is questionable whether *M. costaricensis*, *M. gatunensis*, and *M. oerstedeana* are distinct species.

4. SYZYGIUM Gaertn.

SYZYGIUM Gaertn. Fruct. 1:166. 1788.

Opa Lour. Fl. Cochinch. 308. 1790.
Jambosa DC. Prodr. 3:286. 1828.
Microjambosa Blume, Mus. Bot. Lugd.-Bat. 1:117. 1849.

Shrubs or trees. Inflorescence usually centrifugal, cymose, more or less paniculate. Flowers 4-merous. Receptacle produced above the ovary. Sepals persistent, mostly semi-orbiculate, sometimes distinct. Petals free or coherent. Anthers dorsifixed, opening with longitudinal slits. Ovary 2(–4)-celled, the cells many-ovulate. Berry globose or pear-shaped, often carnose and edible, mostly 1-seeded. Testa adhering to the pericarp. Cotyledons free, carnose; radicle short, hidden between the cotyledons.

Distribution: Species about 200 in tropical and subtropical Asia, the following cultivated or sometimes naturalized in Panama.

1a. Flowers red; inflorescence mostly lateral, often cauliflorous..... 1. S. MALACCENSE
b. Flowers white; inflorescence chiefly terminal.....2
2a. Leaves lanceolate, acute at the base..... 2. S. JAMBOS
b. Leaves elliptical-oblong, rounded at the base..... 3. S. SAMARAGNENSE

1. SYZYGIUM MALACCENSE (L.) Merrill & Perry, in Journ. Arn. Arb. 19:215. 1938.

Eugenia malaccensis L. Sp. Pl. 470. 1753.
Jambosa malaccensis (L.) DC. Prodr. 3:286. 1828.
Jambosa domestica Bl. Mus. Bot. Lugd.-Bat. 1:91. 1849.

Low trees with very dense rounded crown. Leaves large, oblong-elliptical, obtuse or acute at the base, acute or acuminate at the apex, coriaceous, glabrous, 20–30 cm. long and 8–18 cm. wide, the lateral nerves in about 10–14 pairs. Inflorescences lateral, few-flowered. Flowers red. Receptacle glabrous. Sepals 4–8 mm. long. Petals orbiculate, red, 14–18 mm. long. Stamen filaments red, greatly exserted; anthers yellow. Berry obovoid, about 7 cm. long, whitish or yellowish or tinged with red.

Native of Asia, sometimes planted as a shade tree. The bright purple red flowers are exceptionally beautiful. They are borne amongst the leaves however and are not conspicuous when the tree is viewed from a distance; but the petals fall upon the bare soil beneath and form a lovely carpet. The fruit is called *marañón de Curasao*, a not inappropriate name, since the fruit strongly suggests, in shape and color, that of *Anacardium occidentale* L., called *marañón* throughout Central America. Another name is Malay apple or *manzana de Faiti*.

2. SYZYGIUM JAMBOS (L.) Alston, in Trimen, Handb. Fl. Ceylon 6: Suppl. 115. 1931.

Eugenia jambos L. Sp. Pl. 470. 1753.
Jambosa vulgaris DC. Prodr. 3:286. 1828.

Small trees though often 15 m. high, with a dense crown of green foliage. Leaves lanceolate, attenuate toward the acute apex, acute at the base, glabrous, coriaceous, 15–20 cm. long and 4–6 cm. wide, the lateral nerves in about 8 pairs, the marginal nerve at about 4 mm. from the margin. Inflorescence few-flowered, terminal, glabrous. Flowers, including the many filaments, about 5 cm. in diameter Receptacle glabrous, 1.5 cm. high. Sepals 4, semi-orbiculate. glabrous, about 7 mm. long. Petals about 1 cm. long, white. Berry pear-shaped or subglobose, about 3 cm. in diameter and 3.5–5.0 cm. long, pinkish or yellowish, 2- or several-seeded, crowned with the persistent incurved sepals.

Native of the East Indies and widely cultivated as a shade tree throughout tropical America because of the dense foliage, showy flowers and edible fruits. The fruit is not much esteemed in Central America, although elsewhere it is much used for the making of jellies. Known as *manzana* and *manzana rosa*, and in Panama the tree is usually called *pomarosa*; in English Rose apple, Malabar plum and Plum rose. It frequently escapes and naturalizes in Panama.

3. SYZYGIUM SAMARAGNENSE (Blume) Merrill & Perry, in Journ. Arn. Arb. 19: 115. 1938.

Eugenia javanica Lam. Encycl. 3:200. 1789, non *Sysyzium javanicum* Miq.
Myrtus samaragnensis Blume, Bijdr. 1084. 1826.
Jambosa samaragnensis (Blume) DC. Prodr. 3:286. 1828.

Trees. Leaves elliptical-oblong, rounded or subcordate at the base, mostly obtusely acuminate at the apex, 10–24 cm. long and 4–11 cm. wide, chartaceous, glabrous, aromatic. Inflorescence terminal or lateral, in the first case often many-flowered, the flowers usually in clusters of 3. Receptacle cup-like, produced above the ovary, about 12 mm. high. Sepals 4, semi-orbiculate, glabrous, about 4 mm. long. Petals and stamen filaments yellowish white, the petals about 1 cm. long, concealed by the elongate stamens. Berry pear-shaped or subglobose, about 3–5 cm. long, pinkish or white, carnose, insipid.

Native to the East Indies but cultivated throughout the tropics. In Panama it is less common than the two other species.

5. MYRCIARIA Berg

MYRCIARIA Berg, in Linnaea 27:320. 1856.

Shrubs or trees. Flowers subsessile, glomerate, axillary and lateral. Bractlets 2, enclosing the ovary, often connate at the base. Receptacle distinctly produced above the ovary, at last circumscissile. Sepals 4, imbricate in the bud and enclosing the petals. Petals small, fimbriate. Stamens numerous; filaments incurved in the bud; anthers ovate, dorsifixed, opening with longitudinal slits. Ovary 2- to 3-celled; cells 2- or 4-ovulate, the ovules ascending. Berry globose, crowned with the disc only. Embryo undivided.

Distribution: Species about 40 in tropical America.

1a. Leaves 2–5 (–7) cm. long, acute at the base..... 1. M. FLORIBUNDA
b. Leaves 5–12 cm. long, rounded to cordate at the base..... 2. M. VISMEAEFOLIA

1. MYRCIARIA FLORIBUNDA (West, ex Willd.) Berg, in Linnaea 27:330. 1856.

Eugenia floribunda West, ex Willd. Sp. Pl. 2:960. 1800.
Eugenia O'Neillii Lundell, in Bull. Torrey Bot. Club 64:555. 1937.
Myrciaria O'Neillii (Lundell) I. M. Johnston, in Sargentia 8:228. 1949.

Shrubs or small trees 2–10 m. high. Trunk 3–25 cm. in diameter, covered with a tight smooth light-brown exfoliating bark that is practically indistinguishable from that of its common associate *Calycolpus* (cf. I. M. Johnston, loc. cit. 1949). Twigs densely foliate, the internodes 1–2 cm. long, at first puberulous, soon glabrate. Leaves elliptic- to lanceolate-oblong or lanceolate, long-acuminate to caudate at the apex, acute at the base, 2–5 (–7) cm. long and 1.0–2.5 cm. wide, chartaceous, at first pubescent on the margin and midrib, soon glabrate, the midrib flat above, prominent beneath, the lateral nerves numerous, delicately prominulous to nearly obsolete on both sides, the marginal nerve 0.5–1.0 mm. within the margin; petiole slender, 2–5 mm. long. Flowers glomerate, 2–5 together. Receptacle glabrous, about 1.5 mm. long, at last circumscissile above the ovary. Sepals 4, imbricate, about 1 mm. long, deciduous with the receptacle. Petals obovate, fimbriate, slightly longer than the sepals. Ovary glabrous outside. Berry globose,

Fig. 53 *Myrciaria floribunda*

8–15 mm. in diameter, 1-seeded, edible. Embryo homogeneous; radicle broadly adnate.

Southern Mexico to Panama; Guiana and Brazil; West Indies. A common element in the understory of more or less shady forest at low elevations.

CANAL ZONE: hills north of Frijoles, *Standley 27521*; between France Field and Catival, Prov. Colón, *Standley 30192*; without precise locality, *Mrs. Epplesheimer anno 1910*. CHIRIQUÍ: east of Gualaca, *Allen 5027*. COCLÉ: vicinity of Natá, *Allen 837*; Bismarck, above Penonomé, 2000–3000 ft., *Williams 583*. PANAMÁ: San José Island, *Johnston 222, 283, 310, 435, 500, 523, 578, 603, 617, 715, 749, Erlanson 271*.

2. MYRCIARIA VISMEAEFOLIA (Benth.) Berg, in Linnaea 27:336. 1856.

Eugenia vismeaefolia Benth. in Hook. Journ. Bot. 2:320. 1840.

Shrubs or small trees 4–6 m. high, the trunk up to 1 dm. in diameter, the twigs glabrous and with distant foliage. Leaves oblong to lanceolate-oblong, 6–12 cm. long and 2–4 cm. wide, long-acuminate and acute at the apex, rounded or obtuse at the base, coriaceous, glabrous, the midrib slightly elevated above, prominent beneath, the lateral nerves numerous, delicate; petiole about 5 mm. long. Flowers glomerate, axillary and lateral, whitish, the bractlets small, connate, ciliate. Receptacle glabrous, at last circumscissile above the ovary. Sepals glabrous outside, puberulous inside, imbricate in the bud with 2 smaller and 2 larger. Petals 4, about 2 mm. long, pubescent, fimbriate. Ovary 2-celled, 4-ovulate, the ovules ascending. Berry globose, up to 1 cm. in diameter, 1- to 3-seeded, blackish blue when dry, edible. Embryo homogeneous.

Distribution: Panama, British Guiana and Surinam. The description as given here refers to the Panamanian variety, which differs from the typical form of the Guianas by its firmer leaves which are never (?) cordate at the base, its longer petioles and its slightly larger flowers.

CANAL ZONE: Summit, *Zetek 3520*.

6. EUGENIA L.

EUGENIA L. Sp. Pl. 470. 1753.

Catinga Aubl. Hist. Pl. Guian. 1:511. *t. 203*. 1775.
Greggia Gaertn. Fruct. 168. *t. 33*. 1788.
Guapurium Juss. Gen. 324. 1789.
Olynthia Lindl. Collect. *t. 19*, in obs. 1821.
Jossinia Comm. ex DC. Prodr. 3:237. 1828.
Calophylloides Smeathm. ex DC. loc. cit. 272. 1828.
Opaneo Raf. Sylva Tellur. 106. 1838.
Epleienda Raf. loc. cit. 107. 1838.
Lomastelma Raf. loc. cit. 1838.
Malidra Raf. loc. cit. 1838.
Suarda Nocca, ex Steud. Nomencl. 2:651. 1841.
Cerocarpus Hassk. in Flora 25:2 Beibl. 36. 1842.
Syllysium Meyen & Schau. in Nova Acta Acad. Nat. Cur. 19: Suppl. 1. 334. 1843.
Phyllocalyx Berg, in Linnaea 27:306. 1856.
Stenocalyx Berg, loc. cit. 309. 1856.
Myrcianthes Berg, loc. cit. 315. 1856.
Hexachlamys Berg, loc. cit. 345. 1856.

Anamomis Griseb. Fl. B. W. I. 240. 1860.
Psidiastrum Bello, in Anal. Soc. Españ. Hist. Nat. 10:272. 1881.
Myrtopsis O. Hoffm. in Linnaea 43:133. 1881.
Pseudoeugenia Scortech. in Journ. Bot. 23:153. 1885.
Oxydiastrum Niedenzu, in Engl. & Prantl, Nat. Pflanzenfam. 3^7:105. 1893.
Chloromyrtus Pierre, in Bull. Soc. Linn. Paris, n. ser. 71. 1898.

Shrubs or trees. Flowers tetramerous, in axillary or lateral racemes, fascicles or glomerules, rarely solitary or cymose. Receptacle scarcely or not produced above the ovary. Sepals free, imbricate, the two inner mostly distinctly larger than the two outer, persistent. Petals free, often caducous. Stamens numerous; filaments incurved in the bud; anthers dorsifixed, opening with longitudinal slits. Ovary 2(–3)-celled, the cells several- to many-ovulate, sometimes only 2-ovulate. Berry globose or ellipsoid, mostly 1-seeded, rarely few-seeded. Embryo homogeneous, the radicle broadly adnate to the wholly connate cotyledons, or sometimes cotyledons with a short split between them (or in one species in Panama, also aberrant by its cymose inflorescence, with cotyledons free and radicle short but distinct).

Distribution: Species numerous, probably more than 1000, in the tropics and subtropics, chiefly in America. The genus sometimes is united with *Syzygium* Gaertn., and then a few hundred additional species must be added.

1a. Inflorescence cymose, 1- to 7-flowered; cotyledons free ..... 3. E. FRAGRANS
b. Inflorescence various, but never cymose; cotyledons connate 2
2a. Berry distinctly ribbed 3
b. Berry smooth or at most faintly ribbed 4
3a. Leaves ovate; flowers solitary in the axils of bracts at the base of young shoots, or in fascicles of 4–8, the pedicels 1.5 cm. long or more; berry depressed-globose, 2.5–3.0 cm. in diameter ..... 2. E. UNIFLORA
b. Leaves elliptical; flowers in short racemes, the pedicels 4–8 mm. long; berry obovate-oblong, up to 1.5 cm. long ..... 17. E. OCTOPLEURA
4a. Leaves linear, less than 5 mm. wide; flowers solitary, on long slender pedicels ..... 1. E. ALFAROANA
b. Leaves broader, about 1 cm. wide or more; flowers glomerate, fasciculate, or racemose 5
5a. Flowers precocious, fasciculate, the pedicels white-pilose, the ovary densely puberulous; leaves small, about 5 cm. long, the marginal nerve at some distance from the margin ..... 5. E. NESIOTICA
b. Flowers present at the same time as fully developed leaves 6
6a. Leaves small, mostly less than 5 cm. long, subsessile if up to 6 cm. long 7
b. Leaves larger, as a rule more than 5 cm. long, or definitely petiolate if shorter 9
7a. Flowers glomerate; leaves almost sessile, oblong to lanceolate ..... 6. E. PITTIERI
b. Flowers in fascicles or in abbreviated racemes, long-pedicellate 8
8a. Inflorescence an abbreviated 1- to 4-flowered raceme; the pedicels 4–10 mm. long; leaves oblong or lanceolate-oblong ..... 7. E. CHEPENSIS
b. Inflorescence an axillary 6- to 15-flowered fascicle, the pedicels 4–6 mm. long; leaves elliptical ..... 8. E. COSTARICENSIS
9a. Leaves lanceolate, long-acuminate and mucronate, sparsely white-pilose to glabrescent on both sides, up to 7 cm. long; inflorescence and ovary pubescent; flowers racemose ..... 4. E. BIFLORA
b. Leaves elliptical or oblong 10
10a. Twigs glabrous or puberulous; leaves and ovary always glabrous (see also *E. salamancana*, no. 15) 11
b. Young twigs densely pubescent with patent hairs; leaves remaining long-pubescent or sericeous at least beneath; ovary pubescent or glabrous 17
11a. Flowers distinctly racemose (sometimes partly solitary), the rachis much longer than the pedicels; leaves acuminate 12

b. Flowers fasciculate or in more or less abbreviated racemes: leaves obovate, rounded or obtuse and scarcely acuminate at the apex....13
12a. Flowers small, the petals about 3 mm. long; rachis and pedicels very slender.... 11. E. OERSTEDEANA
b. Flowers larger, the petals about 6 mm. long; plant more robust in all parts.... 10. E. COLORADENSIS
13a. Leaves very large, 20–25 cm. long.... 12. E. sp.
b. Leaves much smaller....14
14a. Flowers minute, the sepals about 1 mm. long, the petals about 3 mm. long; inflorescence an abbreviated raceme with slender rachis and pedicels, rarely partly fasciculate.... 13. E. ACAPULCENSIS
b. Flowers larger, the petals 5–7 mm. long; inflorescence more robust....15
15a. Leaves obovate, rounded, obtuse or subtruncate at the apex; inflorescence poorly known but possibly cymose, 3-flowered (but embryo homogeneous).... 14. E. HIRAEIFOLIA
b. Leaves elliptical, ovate or oblong....16
16a. Sepals very short, about 1 mm. long, even in the bud much shorter than the petals.... 16. E. TAPACUMENSIS
b. Sepals larger, unequal, 3–5 mm. long, covering the petals in the bud. 18. E. AUSTIN-SMITHII
17a. Leaves sericeous beneath with a shining golden, eventually fading indumentum; flowers pedicellate.... 19. E. CHRYSOPHYLLUM
b. Leaves pubescent with spreading hairs, glabrescent or glabrous; twigs loosely pubescent....18
18a. Leaves coriaceous, the nerves indistinct and the venation obsolete, glabrous; inflorescence and flowers poorly known.... 15. E. SALAMANCANA
b. Leaves membranaceous, the nerves distinct, glabrous....19
19a. Flowers small, sessile or nearly so, glomerate, the sepals not more than 1 mm. long.... 9. E. ORIGANOIDES
b. Flowers larger, long-pedicellate (up to 1 cm.), fasciculate, the sepals up to 4 mm. long.... 20. E. OREINOMA

The most common species are *E. acapulcensis* and *E. origanoides* which are probably to be found in all provinces. The first species is glabrous and easily recognizable by its minute flowers in slender abbreviated racemes; the second species is pubescent and has equally small but glomerate flowers. *E. biflora*, particularly frequent on Taboga Island but probably scattered throughout the country, has narrowly lanceolate leaves and pubescent few-flowered racemes. *E. fragrans* is particularly frequent in the Chiriquí region, and is the only species with a dichotomously branched inflorescence. *E. oerstedeana* and *E. coloradensis*, both with flowers in long glabrous racemes, *E. chepensis*, with small leaves and flowers in abbreviated, nearly glabrous racemes, and *E. nesiotica*, with pubescent, fasciculate, precocious flowers and small leaves, are most common in the Canal Zone. All other species have been collected but once or twice, some in recent years and others in the last century.

1. EUGENIA ALFAROANA Standl. in Journ. Wash. Acad. Sci. 14:240. 1924.

Shrubs 1–5 m. high, densely branched, the branchlets very slender, thinly pilose-sericeous. Leaves linear or nearly so, often broadened near the base, 5–6 cm. long, 1.5–4.0 mm. wide, acute at the base, acute and aristate-mucronate (bristle about 1.5 mm. long) at the tip, thin, when young thinly sericeous-pilose with whitish hairs, soon glabrate; petioles 2–4 mm. long, tomentose and pilose. Flowers axillary, solitary on long, slender, appressed-pilose pedicels 1.5–2.0 cm. long. Bractlets 2 at the base of the calyx, filiform, 2–3 mm. long. Sepals ovate, subulate-acuminate,

2–3 mm. long, tomentose or glabrate. Petals broad, white, 3 mm. long, ciliolate, copiously gland-dotted. Ovary 2 mm. high, densely white-tomentose, 2-celled, each cell with 3–4 relatively large ovules. Berry purple-black, 6–7 mm. in diameter, glabrate, crowned with the persistent sepals, 1-seeded; seed about 6 mm. in diameter, the embryo homogeneous.

El Salvador, Panama. *Escobar* (in Panama).

CHIRIQUÍ: Sabana de El Boquete, alt. 700–1100 m., *Pittier 3302*.

The specimen cited is sterile; flowering material is needed for more sure determination.

2. EUGENIA UNIFLORA L., Sp. Pl. 470. 1753.

Eugenia michelii Lam. Encycl. 3:203. 1789.
Stenocalyx michelii (Lam.) Berg, in Linnaea 27:310. 1856.

Shrubs or small trees 3–10 m. high. Leaves ovate to ovate-lanceolate, shortly acuminate, obtuse to rounded or subcordate at the base, 2.5–6.0 cm. long and 1.5–3.5 cm. broad, chartaceous, glabrous, lateral nerves prominulous on both sides, arcuate-anastomosing at about 3 mm. within the margin, the veins laxly reticulate; petiole about 2 mm. long. Flowers solitary in the axils of bracts at the base of young shoots or sometimes in fascicles of 4–8; bracts scarious, up to 5 mm. long. Pedicels slender, glabrous, 1.5–2.0 cm. long. Sepals oblong, ciliate, up to 4 mm. long, glabrous. Petals obovate, unguiculate, 8–12 mm. long. Ovary glabrous, 8-ribbed, 2-celled; cells several (10–14-) ovulate; placenta peltate, thickened in the middle. Berry depressed-globose, 8-ribbed, 1-seeded, 2.5–3.0 cm. in diameter, red, edible. Cotyledons partly free.

Cultivated in the tropics and subtropics, native of tropical America. The fruits are edible, sweet, aromatic and of excellent flavor. The shrubs are especially well-adapted to cultivation as a hedge plant (Standley). Vernacular name: Surinam Cherry.

CANAL ZONE: Barro Colorado Island, *Shattuck 71*.

3. EUGENIA FRAGRANS (Swartz) Willd. Sp. Pl. 2:964. 1800.

Myrtus fragrans Swartz, Prodr. Veg. Ind. Occ. 79. 1788.
Anamomis fragrans (Swartz) Griseb. Fl. Brit. W. Ind. 240. 1860.
Eugenia storkii Standl. in Field Mus. Publ. Bot. 8:143. 1930.
Myrcia seleriana Donn. Sm. in Bot. Gaz. 27:332. 1894.

Small trees 3–8 m. high, almost glabrous. Leaves petiolate, elliptic to obovate, acute at the base, obtuse or very shortly acuminate at the apex, 2–6 cm. long and 1.5–3.0 cm. wide, thick and coriaceous, glabrous, the midrib impressed above, prominent beneath, the lateral nerves usually prominulous on both sides. Flowers in axillary 3- to 7-flowered cymes, the central flower(s) sessile, the lateral pedicellate. Peduncle up to 3.5 cm. long. Flowers 4-merous, white, fragrant. Sepals about 2 mm. long, glabrous except at the margin. Ovary with sparse hairs, 2-celled, many-ovulate. Petals glabrous, about 3 mm. long. Anthers orbiculate.

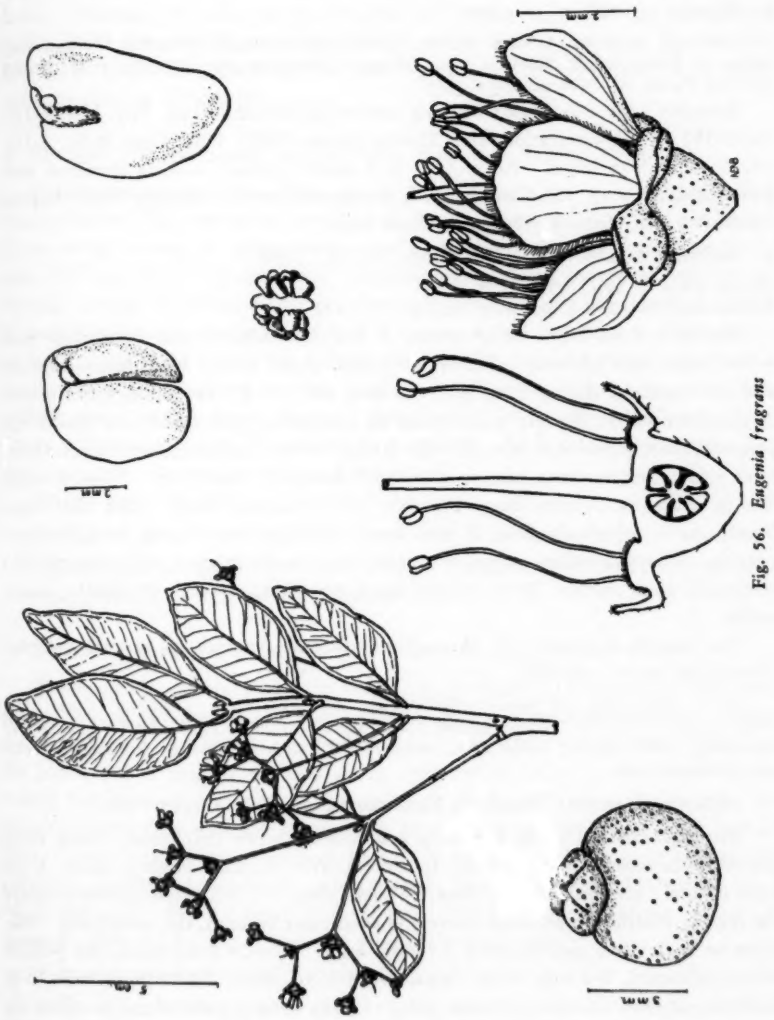

Fig. 56. *Eugenia fragrans*

Berry globose or ellipsoid, glabrous, orange, 1- or 2-seeded (or rarely more), 8 mm. long or larger. Cotyledons free with a short radicle between them.

West Indies and Central America. The Central American form is always with 4-merous flowers, the West Indian sometimes with 5-merous flowers. In Panama at altitudes of 1000 m. or more.

CHIRIQUÍ: outskirts of wood, Volcán de Chiriquí, *Seemann 1150*; Río Chiriquí Viejo valley, *G. White 108, P. White 217, 211*; Boquete, *Davidson 460, 774, 821, 1062*; vicinity of Cerro Punta, alt. 2000 m., *Allen 1563*.

Seemann 1150 was named *Eugenia arayan* by Seemann (Bot. Voy. Herald 125. 1852–59) in mis-association with *Myrtus arayan* HBK. Nov. Gen. & Sp. 6:133. 1823, a Peruvian plant. *Allen 1563* is a rather distinct looking specimen with suborbiculate, very rigid leaves with impressed nerves agreeing with *Eugenia rigidissima* Cuf. from a volcano in Costa Rica.

4. EUGENIA BIFLORA (L.) DC. Prodr. 3:276. 1828.

Myrtus biflora L. Syst. 1056. 1759.
Eugenia sericiflora Benth. Bot. Voy. Sulphur 89. 1844.

Shrubs 3–4 m. high; twigs terete, at first brown-tomentose intermixed with white hairs, later glabrate. Leaves lanceolate, acute at the base, long-acuminate and mucronate at the apex, up to 7 cm. long and 1.0–2.5 cm. wide, subcoriaceous or membranaceous, sparsely white-pilose on both sides, glabrescent, the midrib impressed above, prominent beneath, the lateral nerves numerous, inconspicuous on both sides. Inflorescence racemose, 3- to 7-flowered, tomentose. Flowers white. Bracts setaceous, 2 mm. long; bractlets also setaceous, longer than the ovary. Sepals ovate, apiculate, about 2 mm. long. Petals about 4 mm. long, sericeous outside. Ovary 2-celled, sericeous; ovules about 6–10 in each cell, arranged in a semicircle open above. Berry subglobose, 7 mm. long, smooth or faintly ribbed, edible.

The species is distributed throughout tropical America in several varieties. Vernacular name: *coralillo*.

COCLÉ: Penonomé and vicinity, *Williams 63, 188, 355, 2776*. CHIRIQUÍ: Cerro Vaca, *Pittier 5316*. PANAMÁ: Taboga Island, *Maxon 6920, Macbride 2776, Barclay 977, Standley 27024, 27886, 29732, Miller 1843, 2034, Pittier 3525*. VERAGUAS: Santiago de Veraguas, *Seemann 1149*.

5. EUGENIA NESIOTICA Standl. in Field Mus. Publ. Bot. 17:203. 1937.

Densely branched shrub flowering precociously while defoliated; young twigs grayish-puberulous, terete, densely foliate. Leaves elliptical-oblong, acute at the base, obtusely acuminate at the apex, 4–5 cm. long, 1–2 cm. wide, glabrous except the midrib, midrib prominulous above and prominent beneath, the veins finely reticulate on both sides; petiole about 2.5 mm. long. Flowers fasciculate, the pedicels white-pubescent, 5–6 mm. long. Sepals puberulous, about 2 mm. long, reflexed at anthesis. Petals orbicular, 3.5 mm. long. Ovary densely puberulous, 2-celled, the cells about 6-ovulate. "Berry resembling a huge cherry in color and texture, 2.5–3.0 cm. in diameter, the flesh about 0.5 cm. thick, the taste acid, edible. Seed single, sphaerical, covered with fibre (Zetek)."

Endemic. Vernacular name: *guayabillo.*

CANAL ZONE: Barro Colorado Island, *Zetek 3646, 3835, 3482, Starry 169, Standley 40987*; Obispo, *Standley 31712.*

This is one of the very few Myrtaceae in which the flowers develop before the leaves. The small reticulate leaves with the midrib elevated above characterize this species even when sterile. A species with rather similar leaves is *E. chepensis* Standl., in which the reticulation is more obscure and the marginal nerve single and very close to the margin.

6. EUGENIA PITTIERI Standl. in Field Mus. Publ. Bot. 8:145. 1930.

Slender shrubs 1.0–4.5 m. high; young twigs densely and minutely pubescent, densely foliate the internodes 1.0–2.5 cm. long. Leaves more or less distichous, almost sessile. oblong to oblanceolate, acute at the base, obtusely acuminate at the apex, 4–6 cm. long, 1–2 cm. wide, membranous, glabrous except on midrib and margin, densely glandular-punctate, the midrib flat or slightly elevated above, prominulous beneath, the principal lateral nerves several but distant, diverging at an angle of about 60° with the midrib, delicate, the marginal nerve very close to the margin, the reticulation obscure throughout. Flowers minute, glomerate, few, axillary and lateral. Sepals nearly 1 mm. long. Petals obovate, 2 mm. long. Ovary glabrous, 2-celled, the cells 4- to 6-ovulate. Berry subglobose, sessile, 5–7 mm. long, red, crowned by the persistent sepals.

Panama and Costa Rica, at low altitudes.

PANAMÁ: banks of Mamoní R., below La Capitana, *Pittier 4484.*

The second Panamanian specimen cited by Standley, *Mrs. A. P. Applesheimer s. n.* is a specimen of *Myrciaria floribunda.*

7. EUGENIA CHEPENSIS Standl. in Field Mus. Publ. Bot. 8:144. 1930.

Slender shrubs 2–3 m. high, the young twigs densely and minutely pubescent, densely foliate. Leaves more or less distichous, oblong or lanceolate-oblong, attenuate at both ends, up to 4.5 cm. long and 1–2 cm. wide, membranous, glabrous, the midrib flat or slightly elevated above, prominulous beneath, the lateral nerves several but distant, diverging at an angle of about 60° from the midrib, the marginal nerve very near the margin, the reticulation obscure throughout; petiole about 2 mm. long. Flowers axillary, in a 1- to 4-flowered abbreviated raceme, the peduncle and pedicels minutely pubescent, the pedicels slender, 4–10 mm. long. Petals not seen. Fruit a small globose berry, green to purple, about 6 mm. in diameter, crowned by the 4 persistent semi-orbiculate sepals.

Nicaragua and Panama, at low elevations.

CANAL ZONE: forest between Peluca Hydrographic Station and Quebrada Peluca, *Steyermark & Allen 17250*; forest between Quebrada La Palma and cañon of Río Chagres, *Dodge & Allen 17362*; upper Río Chilibre, *Seibert 1501*; Gatún, *Hayes 77, 236, 610*; Chagres, *Fendler 189*; without locality, *Hayes 255.* PANAMÁ: along Río Charara, near Chepo, *Pittier 4716.*

8. EUGENIA COSTARICENSIS Berg, in Linnaea 27:213. 1856.

Slender shrubs, the young twigs minutely pubescent, soon glabrate, densely foliate. Leaves more or less distichous, elliptical, acute at the base, obtusely acuminate at the apex, 3–4 cm. long and 1–2 cm. wide, chartaceous, glabrous, finely reticulate, the midrib impressed above and prominent beneath, the lateral nerves several but distant, delicate, the marginal nerve very near the margin; petiole slender, 4–6 mm. long, glabrous. Flowers in axillary 6- to 15-flowered fascicles, the pedicels slender, sparsely pubescent, 4–6 mm. long, the peduncle practically absent. Sepals 4, the larger about 1.5 mm. long. Petals suborbiculate, about 2.5 mm. long. Style glabrous. Ovary glabrous, many-ovulate. Berry not seen.

Costa Rica and Panama, at higher elevations, to 1900 meters.

VERAGUAS: locality unknown, *Warscewicz s. n.* (not seen).

In Berg's day, "Veraguas" included all of western Panama. From the description, this appears to be a very distinct species, but more recent collections have failed to include it.

9. EUGENIA ORIGANOIDES Berg, in Linnaea 29:229. 1858.

Eugenia banghamii Standl. in Journ. Arnold Arb. 11:125. 1930.

Shrubs or trees 2.5–6.0 m. high; twigs densely brown-pubescent with spreading hairs, glabrescent. Leaves elliptical to oblong, acute to rounded at the base, shortly acuminate at the apex, 5–10 cm. long and 2–5 cm. wide, at first pubescent on both sides, at length glabrate except on the midrib, the midrib scarcely impressed above, prominent beneath, the lateral nerves about 10 on each side, prominulous on both surfaces, passing into a marginal nerve at about 2–3 mm. distance from the margin; petiole robust, 3 mm. long, pubescent. Flowers glomerate, axillary, small, sessile or nearly so, white or pale yellow. Sepals ciliate, up to 1 mm. long. Petals obovate, 3 mm. long, glabrous. Ovary sparsely pubescent, 2-celled; cells about 5-ovulate. Berry globose, not more than 6 mm. in diameter, red to purplish-black, with thin juicy pericarp, 1-seeded.

Distribution: Mexico to Colombia.

CANAL ZONE: shores of Gatún Lake, south of Lab., *Bangham 488*; Ancón Hill, *Seibert 406*, *Woodson, Allen & Seibert 1318*, *Standley 26378*, *29722*; Barro Colorado Island, *Shattuck 1043*, *Aviles s. n.* COCLÉ: Penonomé and vicinity, *Williams 214*; between Las Margaritas and El Valle, *Woodson, Allen & Seibert 1727*; Llano Bonito, north of Las Margaritas, *Seibert 531*. PANAMÁ: in woods near Panamá, *Hayes 678*; San José Island, Perlas Archipelago, *Johnston 137*, *387*, *741*, *779*, *489*, *Erlanson 66*; near Punta Paitilla, *Standley 26275*; vicinity of Juan Franco Race Track, near Panamá, *Standley 27790*, *27719*.

10. EUGENIA COLORADENSIS Standl. in Trop. Woods 52:27. 1937.

Eugenia melanosticta Standl. in Journ. Arnold Arb. 11:126. 1930, non Koorders & Valeton.

Glabrous shrubs or trees. Leaves oblong, or elliptical- to obovate-oblong, acute at the base, shortly and acutely acuminate at the apex, 8–17 cm. long, about 7.5 cm. wide, quite variable in size, membranaceous to coriaceous, glabrous, the midrib

impressed above, prominent beneath, the lateral nerves in about 10 pairs, inconspicuous above, prominulous beneath, arcuate, anastomosing near the margin. Inflorescences axillary, few-flowered, racemose, the racemes often gathered into a panicle, the rachis and the pedicels rather robust, the pedicels 4–7 mm. long. Sepals semi-orbiculate, unequal, the larger up to 2.5 mm. long. Petals oblong, nearly 7 mm. long. Ovary glabrous, 2-celled; ovules about 4–5 in each cell, pendulous. Berry ovoid-globose, 10–12 mm. long, crowned by the conspicuous sepals.

Costa Rica and Panama. Known as *guayabito de monte.*

CANAL ZONE: Lion Hill station, *Hayes s. n.*; Barro Colorado Island, *Aviles 21*, *Shattuck 1118*, *Bangham 445*, *Salvoza 909*, *Zetek 4568.*

Perhaps not distinct from the following:

11. EUGENIA OERSTEDEANA Berg, in Linnaea 27:285. 1856.

(?) Eugenia balancensis Lundell, in Phytologia 1:481. 1941.

Glabrous trees, twigs slender, much branched. Leaves ovate or oblong, acute at the base, long-acuminate at the apex, 4–8 cm. long and 2–4 cm. wide, membranaceous, glabrous, the midrib impressed above, prominent beneath, the lateral nerves up to about 12 pairs, delicate, inconspicuous, arcuate-anastomosing at about 2–4 mm. from the margin; petiole about 4 mm. long. Racemes glabrous or minutely puberulous, axillary, sometimes the flowers partly solitary, the fully developed racemes 7- to 11-flowered, the rhachis 2–3 cm. long, the pedicels filiform, 3–5 (–10) mm. long, the uppermost flower usually sessile. Flowers white, small. Sepals up to 1.5 mm. long. Petals 3 mm. long, not covered by the calyx in the bud. Ovary glabrous, 1 mm. high. Berry globose, 1-seeded, crowned by the small calyx.

Mexico, Costa Rica and Panama, in shady forests. Vernacular name: *sequarra.*

CANAL ZONE: in forest near the northerly arm of Quebrada Salamanca, *Steyermark & Allen 17149*; Río Paraíso, *Standley 29853*; Darién station, *Standley 31596.* CHIRIQUÍ: Progreso, *Cooper & Slater 158.* PANAMÁ: in woods near the Hacienda de Juan Lanas, *Seemann 476*; Bojio station, *Hayes 600*; in woods near Manuel station, *Hayes s. n.*

Closely allied to the preceding species, but apparently more slender in all parts and with smaller flowers and leaves.

12. EUGENIA sp.

Shrubs or small trees about 4 m. high. Leaves oblong, rounded at base, obtuse at apex, 20.0–26.5 cm. long and about 10 cm. wide, coriaceous, glabrous, discolorous, the midrib flat above, prominent beneath, the lateral nerves numerous, the principal ones in about 20 pairs, prominulous, the lesser ones prominulous above and obsolete beneath; petiole about 5 mm. long. Flowers apparently lateral, fasciculate, possibly sessile. Berry oblong, tomentose, about 2 cm. long and 1 cm. broad, crowned by 4 rounded sepals up to 3 mm. long.

DARIÉN: Paca, just below Cana, *Williams 701.*

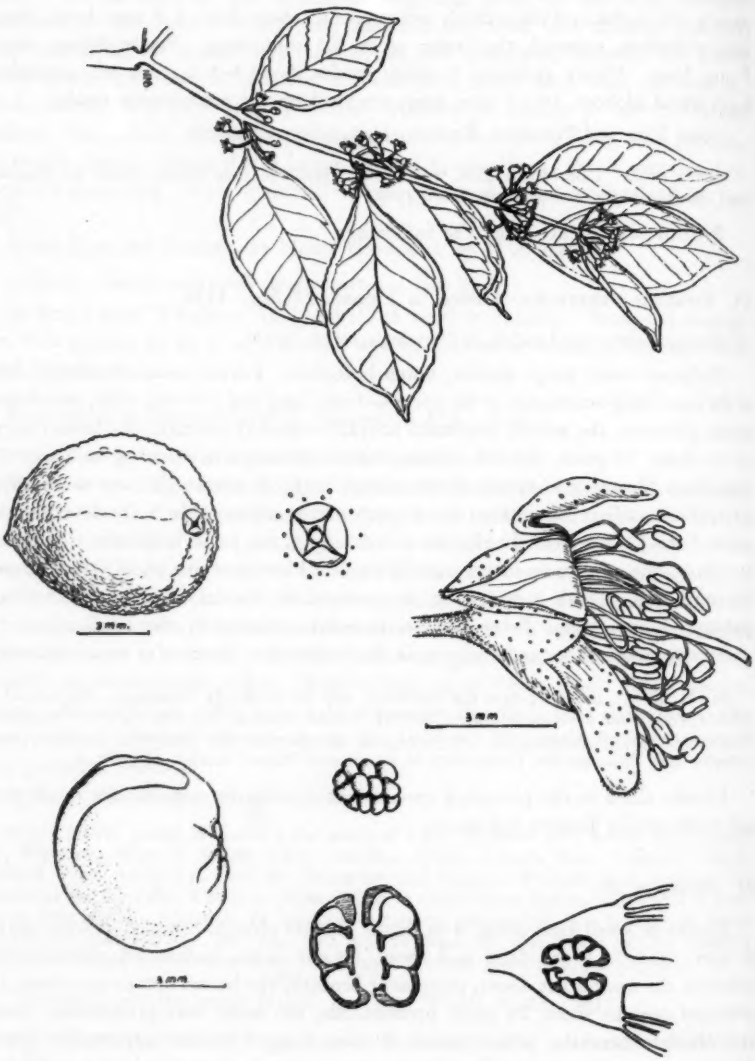

Fig. 57. *Eugenia acapulcensis*

Although quite distinct in appearance, the material presently available is insufficient for the purpose of formal designation.

13. EUGENIA ACAPULCENSIS Steud. Nomencl. Bot. 1:601. 1840.

Myrtus maritima HBK. Nov. Gen. & Sp. 6:146. 1823.
Eugenia maritima (HBK.) DC. Prodr. 3:282. 1828, non *E. maritima* DC. loc. cit. 3:271. 1828.
Eugenia colipensis Berg, in Linnaea 29:243. 1858.
(?) Eugenia cartagenensis Berg, loc. cit. 1858.
Eugenia antiquae Riley, in Kew Bull. 1927:121. 1927.

Shrubs or trees 3–12 m. high, with glabrous twigs. Leaves elliptic, rarely oblong or lanceolate, acute or attenuate at the base, shortly and obtusely acuminate at the apex, 5–12 cm. long and 2–6 cm. wide, glabrous but densely glandular-punctate, the midrib slightly impressed above, prominent beneath, the lateral nerves distant, in 6–9 pairs, prominulous on both surfaces, the lower ones curved at their base, passing into a marginal nerve at about 1–3 mm. distance from the margin; petiole up to 1 cm. long. Flowers green or white, very small, in numerous axillary abbreviated racemes, the rachis up to 1 cm. long though often much shorter (in the latter case perhaps accrescent during fruiting), the pedicels filiform, glabrous or puberulous. Ovary glabrous. Sepals 4, very short and scarcely 1 mm. long, semi-orbiculate. Petals densely glandular-punctate, about 3 mm. long. Berry globose, dark red to black (or sometimes yellow?), about 8 mm. in diameter, crowned with the very small connivent sepals. Embryo homogeneous.

A polymorphic species distributed throughout Central America. In Panama it seems to be the most common Myrtacea, on the Pacific coast especially frequent. Possibly extending to Colombia and scarcely distinguishable from some forms of the West Indian *E. axillaris* (Sw.) Willd. *Eugenia cartagenensis* Berg, described from Costa Rica, is apparently nothing more than a small-leaved *E. acapulcensis*, although with ovoid fruit (always?). The latter form is represented in Panama by *Williams 58* and *Allen 2516* from Coclé, but with globose fruits. *Eugenia antiquae* Riley was described from a Panama specimen, and that name must be used in Panama if several species are recognized. Vernacular name in Panama: *paico.*

CANAL ZONE: vicinity of Miraflores Lake, *P. White 108, 118, G. White 147, Allen 1712*; Chagres, *Fendler 183*. CHIRIQUÍ: Finca Lérida, *Woodson & Schery 210*. PANAMÁ: savana east of Pacora, *Woodson, Allen & Seibert 726*; Isla Taboga, *Woodson, Allen & Seibert 1483*; hills above Campana, *Allen 1324*; Old Panamá, *Riley 142*; Sabanas, Panamá, *Riley 110*; El Jagua Hunting Club on Río Jagua and Congor Hill, *Hunter & Allen 478*; Trapiche Island, *Allen 2631*; Saboga Island, *Miller 1955*; San José Island, *Johnston 727, 734, 736, 748*.

14. EUGENIA HIRAEIFOLIA Standl. in Field Mus. Publ. Bot. 17:202. 1937.

Shrubs or trees. Leaves obovate, cuneate toward the base, obtuse or subtruncate and very shortly apiculate at the apex, 12–14 cm. long and 6–8 cm. wide, glabrous, the midrib impressed above and prominent beneath, the lateral nerves straight, in about 8–11 pairs, arcuate-anastomosing at some distance from the

margin but for the greater part straight, ascending, nearly obsolete above, prominent beneath; petiole robust, about 7 mm. long. Inflorescence (imperfectly known) apparently cymose, 3-flowered; peduncle robust, about 2 cm. long. Flowers not known. Berry large, obovoid, 1-seeded, about 2.5 cm. long and 1 cm. broad, crowned by the persistent 4-merous calyx. Embryo homogeneous.

Endemic. A rather distinct but still imperfectly known species. The leaves, by their venation, are strongly suggestive of a *Psidium*.

PANAMÁ: Monte Obscuro, near Panamá City, *Zetek 3550*.

A deflorated specimen collected by Davidson (no. *439*) in Chiriquí Province, near Bajo Chorro, comes near *E. hiraeifolia*, but seems distinct by the definitely acuminate leaves, the fasciculate inflorescences which are mixtures of 1-flowered pedicels and one or two few-flowered racemes, and larger sepals up to 5 mm. long.

15. EUGENIA SALAMANCANA Standl. in Ann. Missouri Bot. Gard. 26:295. 1939.

Trees up to 6 m. high, the twigs terete, at first densely brown-pubescent, soon glabrate. Leaves oblong or elliptical-oblong, rounded and shortly caudate-acuminate at the apex, narrowly rounded toward the base, 7–9 cm. long and 2.5–4.0 cm. wide, concolorous, glabrous with the exception of the midrib, the midrib slightly impressed above, prominent beneath, the lateral nerves about 12 on each side, obscure, the veins obsolete. Flowers probably sessile, solitary or in clusters of few, lateral on the lower defoliated part of the twigs. Mature flowers and fruit not known.

Endemic. An imperfectly known species.

CANAL ZONE: vicinity of Salamanca Hydrographic Station, Río Pequení, alt. 80 m., *Woodson, Allen & Seibert 1570*.

16. EUGENIA TAPACUMENSIS Berg, in Linnaea 27:222. 1856.

Eugenia ochra Berg, loc. cit. 216. 1856.
Eugenia roraimana Berg, loc. cit. 219. 1856.

Subglabrous shrubs or small trees up to 10 m. high. Leaves ovate- to elliptical-oblong, obtuse or shortly and obtusely acuminate at the apex, obtuse or acute at the base, 5–15 cm. long and 4–7 cm. wide, chartaceous to coriaceous, glabrous, the midrib impressed or sulcate above, prominulous toward the base below, the lateral nerves about 12–14 on each side, oblique, prominulous on both sides, arcuate-anastomosing into a marginal nerve 2–3 mm. within the margin; petiole 4–10 mm. long. Flowers mostly borne on the defoliated branchlets, pink or white, in short racemes or fascicles of 2–15, subglabrous, the rachis if well developed up to 8 mm. long, the pedicels 3–5 mm. long. Calyx waxen-white, the sepals rounded, glabrous, ciliate, about 1 mm. long, even in the bud much shorter than the petals. Petals chartaceous, orbiculate, about 5 mm. long. Ovary globose, glabrous, 2-celled; placenta peltate; ovules about 15 in each cell. Berry subglobose, black, when dry about 1 cm. in diameter; testa of seeds shiny; embryo undivided.

Panama to the Guianas and Peru; West Indies (Martinique, St. Vincent).

CANAL ZONE: Río Grande railway station, *Hayes 344*. PANAMÁ: in woods near Panamá, *Hayes s. n.*

It is odd indeed that no more recent records of this species are available.

17. EUGENIA OCTOPLEURA Krug & Urban, in Engl. Bot. Jahrb. 19:653. 1895.

Shrubs 3–5 m. high, the young twigs very shortly pubescent at their tips with dibrachiate hairs, soon glabrate. Leaves elliptical or elliptical-oblong, acute at the base, obtusely acuminate at the apex, 7–13 cm. long and 4–5 cm. wide, coriaceous, glabrous, the midrib impressed above, prominent beneath, the lateral nerves in about 12 pairs, obsolete above, prominulous beneath; petiole 8–10 mm. long. Inflorescence shortly racemose, 2- to 8-flowered, as long as the petiole or somewhat shorter, sparsely sericeous; pedicels 4–8 mm. long. Flowers 4-merous. Sepals unequal, the 2 outer orbiculate, 2.5–3.0 mm. long, the 2 inner 1.0–1.5 mm. long. Petals obovate, 3–4 mm. long. Ovary obconic, pubescent outside but glabrescent, 2-celled; ovules 12–18 in each cell, inserted on a peltate placenta. Berries obovate-oblong, distinctly 8-ribbed, up to 1.5 cm. long.

Lesser Antilles (Guadeloupe, Martinique, and Dominica) and Panama.

CANAL ZONE: Maumey station, Panamá Railroad, *Hayes 577*.

18. EUGENIA AUSTIN-SMITHII Standl. in Field Mus. Publ. Bot. 18:1561. 1938.

Trees with slender glabrous twigs. Leaves elliptical-oblong to ovate-oblong, acute at the base, acuminate at the apex, 6–7 cm. long and 2.5–3.5 cm. wide, coriaceous, glabrous, the midrib impressed above, prominulous beneath, the lateral nerves about 12 on each side, prominulous on both surfaces; petiole canaliculate, up to 8 mm. long. Flowers mostly cauliflorous; pedicels robust, up to 1 cm. long. Flower buds pear-shaped, the sepals enclosing the petals. Sepals greenish, rounded, reflexed at anthesis, thick, unequal, the 2 inner up to 5 mm. long, the 2 outer nearly 3 mm. long. Petals white, about 7 mm. long. Ovary obconoid, glabrous or with a few hairs, 2-celled, about 3 mm. high, the cells about 12-ovulate. Berry said to be oblong or globose, deep crimson, about 2.0–2.5 cm. in diameter.

Originally described from Costa Rica, in dry woods at medium altitudes. No specimens from Panama have been seen by the writer, but it is to be expected in the highlands of western Panama.

19. EUGENIA CHRYSOPHYLLUM Poir. in Lam. Encycl. Suppl. 3:129. 1813.

Eugenia cricamolensis Standl. in Field Mus. Publ. Bot. 4:242. 1929.

Shrubs or trees; young twigs brown-tomentose, soon glabrate. Leaves oblong to lanceolate-oblong, long acuminate at the apex, acute at the base, 7–15 cm. long and 3–5 cm. wide, chartaceous to coriaceous, the young leaves densely golden brown-sericeous on both sides, soon glabrescent above, with hairs closely appressed, the adult leaves discolorous, glabrate above and paler and appressed-pubescent beneath, the midrib flat, prominulous toward the apex above, prominent beneath, the lateral nerves in about 12–16 pairs, prominulous on both sides; petiole 3–7 mm.

long. Flowers fasciculate or shortly racemose (the rachis up to 5 mm. long), in clusters of 3–8, axillary; pedicels 2–7 mm. long, brown-tomentose; bractlets minute, narrow. Sepals tomentose, very unequal, the 2 outer suborbiculate, about 1.5 mm. long, the 2 inner ovate, about 3 mm. long. Petals obovate or oblong, about 5 mm. long, glandular. Ovary tomentose, 2-celled, many-ovulate. Berry ellipsoid, about 15 mm. long and 9–12 mm. wide in our specimens (up to 2.5 cm. in diameter according to Cooper), grayish-puberulent, 1-seeded, the embryo homogeneous.

Surinam and French Guiana, otherwise known only from the following specimen from Panama. The Panamanian specimen has fewer lateral leaf-nerves than those of the Guianas (12 instead of 16) and also perhaps larger fruits, but otherwise the populations appear to be conspecific. Vernacular name: *cacique*.

BOCAS DEL TORO: region of Almirante, Cricamola valley, *Cooper 511*.

20. EUGENIA OREINOMA Berg, in Linnaea 27:158. 1856.

Small trees 4–5 m. high, the trunk with grayish, exfoliating bark; young twigs and petioles densely pubescent. Leaves ovate or broadly elliptical, rounded or obtuse at the base, shortly acuminate at the apex, 9–12 cm. long and 4.5–6.0 cm. wide, reticulate-veined, sparsely pubescent but glabrescent above, densely pubescent with patent hairs beneath, especially on the nerves, the midrib flat above, prominent beneath, the lateral nerves in about 8 pairs, arcuate-anastomosing at some distance from the margin, prominulous above, prominent beneath; petiole robust, about 5 mm. long, pubescent. Flowers fasciculate but occasionally solitary, the pedicels about 1 cm. long, pubescent. Flowers not known. Fruit globose, usually densely pilose, 1-seeded, about 4 mm. long, black or purplish, crowned by 4 persistent, striate sepals.

Costa Rica and Panama. Vernacular names: *icaquillo, sortija*.

CHIRIQUÍ: Sabana de la Tortuga, between El Boquete and Caldera, alt. 300–700 m., *Pittier 3297*.

7. CALYCOLPUS Berg

CALYCOLPUS Berg, in Linnaea 27:378. 1856.

Trees or shrubs. Inflorescences axillary, usually 1-flowered, rarely 3-flowered, singly or in fascicles of 2–5, at the tips of extremely abbreviate, minutely bracteate shoots; bracteoles very small, paired at the base of the ovary; flowers 5-merous. Sepals large and persistent, coriaceous-foliaceous, patent in the bud. Receptacle not produced above the ovary. Petals obovate, large. Stamens numerous, the anthers linear-oblong, dorsifixed near the base, dehiscing longitudinally. Ovary 3- to 6-celled, many-ovulate; placentas 2-lobed; ovules oblong. Berry subglobose, many-seeded. Seeds hippocrepiform, yellowish white, one side with a blackish spot, shining, finely reticulate, hard. Embryo incurved, the radicle elongate, the cotyledons very small.

Species about 7 in tropical America.

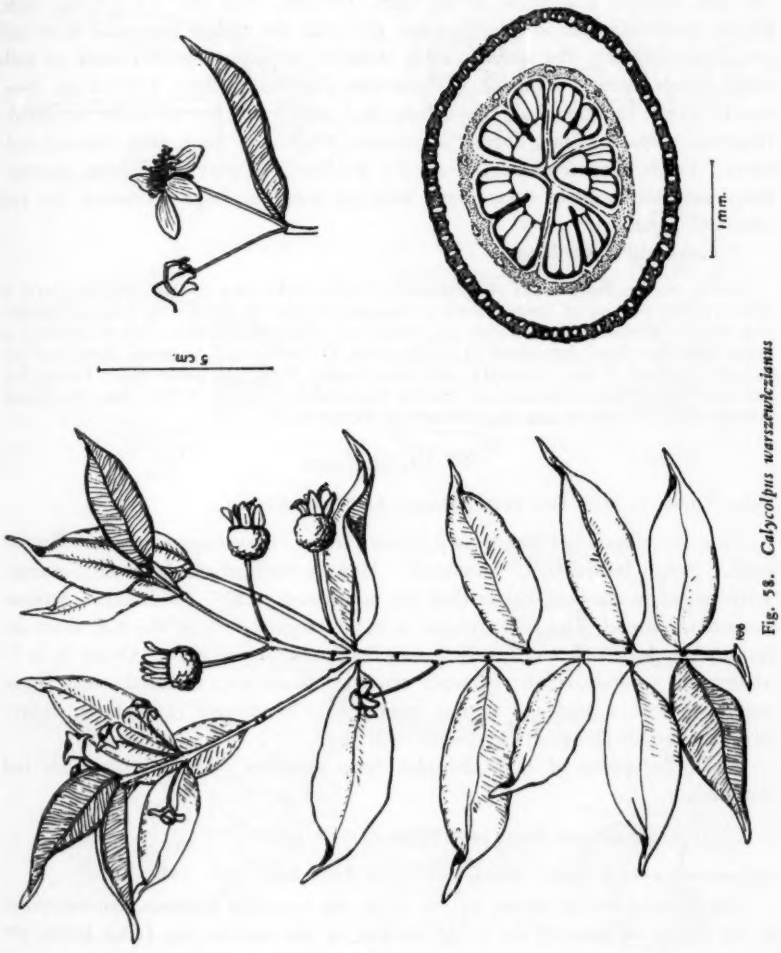

Fig. 58. *Calycolpus warszewiczianus*

1. CALYCOLPUS WARSZEWICZIANUS Berg, in Linnaea 27:382. 1856; Riley, in Kew Bull. 1926:153. 1926.

Glabrous shrubs or small trees up to 7 m. high, with exfoliating bark; twigs subterete or faintly angled. Leaves ovate- or elliptical-oblong, obtuse or acute at the base, acutely acuminate at the apex, 3–8 cm. long and 1.5–3.0 cm. wide, firmly membranaceous to subcoriaceous, glabrous, the midrib impressed above and prominent beneath, the lateral nerves delicate, numerous, prominulous on both sides; petiole up to 3 mm. long. Peduncles glabrous, axillary, 1.5–3.0 cm. long, mostly single; bractlets linear to oblong, 1–3 mm. long; flowers white to pinkish, fragrant. Sepals oblong, obtuse, accrescent, 5–10 mm. long, with distinct midnerve. Petals obovate-oblong, about 1.5 cm. long. Ovary subglobose, glabrous. Berry subglobose, up to 1 cm. long, crowned with the large accrescent disc and persistent sepals.

Panama and Costa Rica.

CANAL ZONE: along banks of Quebrada la Palma and Cañon of Río Chagres, *Dodge & Allen 17339*; vicinity of former town of Empire, *Hunter & Allen 770*; Chagres, *Fendler 105*; Barro Colorado Island, *Wilson 79, Aviles 26, Wetmore & Abbe 171, Woodworth & Vestal 489, Bangham 454*; island in Gatún Lake, *Ostenfeld 104*. COCLÉ: Penonomé and vicinity, *Williams 2, 220*. PANAMÁ: hills near Capira, *Dodge & Hunter 8642*; Pacora, *Bro. Paul 422*; between Las Sabanas and Matías Hernández, *Standley 31870*; San José Island, *Erlanson 60*; in meadows near city of Panamá, *Seemann 282*.

8. UGNI Turcz.

UGNI Turcz. in Bull. Soc. Nat. Moscow 21:579. 1848.

Low much branched and densely foliate shrubs. Leaves opposite or subopposite, small. Peduncles axillary, 1-flowered. Flowers medium-sized, 4- or 5-merous. Sepals patent in the bud, longer than the imbricated petals. Petals firm. Stamens numerous, unequal; filaments straight or hardly curved even in the bud, short and flat; anthers basifixed, 2-celled, dehiscing longitudinally, introrse. Ovary 3- to 5-celled; cells several-ovulate; placenta central. Berry several-seeded; seeds hippocrepiform, with a hard and shining testa with a black spot at one side; embryo incurved; radicle elongate; cotyledons very short.

About 15 species of high altitudes, from southern Chile to Guatemala and Venezuela.

1. UGNI WARSCEWICZII Berg, in Linnaea 27:390. 1856.

Eugenia warscewiczii (Berg) Hemsl. Biol. Centr. Amer. Bot. 1:411. 1880.

Low densely foliate shrubs 2–3 m. high, the branches glabrous, the internodes on the defoliated parts of the twigs marked by the scars of the fallen leaves, the innovation shoots more or less pubescent. Leaves oblong or elliptical-oblong, acute at both ends, up to 15 mm. long and 8 mm. wide, coriaceous, glabrous, more or less impressed-punctate, the midrib impressed above, prominent beneath, the venation obsolete. Pedicels recurved, up to 1 cm. long, pubescent; bractlets linear, ciliate, persistent, longer than the ovary, about 6 mm. long. Sepals lanceolate, obtusish,

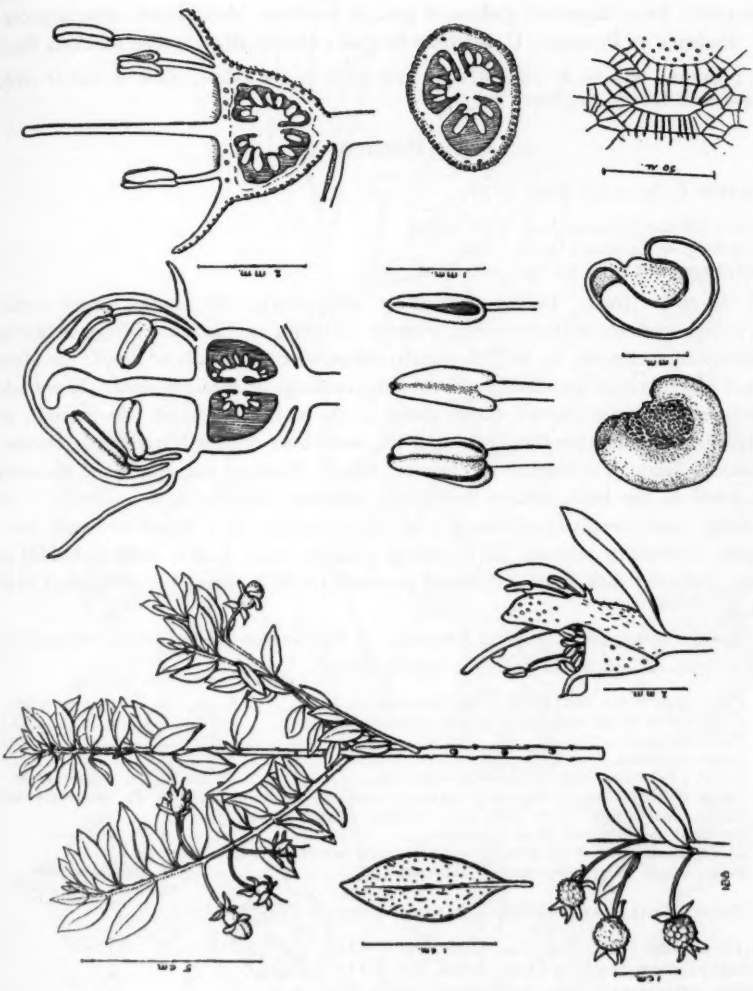

Fig. 59. *Ugni warscewiczii*

about 5 mm. long. Petals obovate, about as long as the sepals. Anthers of the outer stamens lanceolate, acutish, crowned by an apical gland, the anthers of the inner shorter stamens ovate, truncate, without glands; filaments flattened. Ovary glabrous or sparsely pubescent, 3- to 4-celled; ovules inserted on a peltate central placenta. Berry depressed-globose, 8 mm. in diameter, bluish black, several-seeded.

Endemic to Panama. *U. oerstedii* Berg is a closely allied species of Costa Rica.

CHIRIQUÍ: Volcán de Chiriquí, alt. 2500–4000 m., *Woodson, Allen & Seibert 1066, Woodson & Schery 439, Pittier 3075.*

9. PSIDIUM *L.*

PSIDIUM L. Spec. Pl. 470. 1753.

Guiava [Tourn.] Adans. Fam. 2:88. 1763.
Acca Berg, in Linnaea 27:138. 1856.
Calyptropsidium Berg, loc. cit. 349. 1856.

Shrubs or trees. Leaves opposite or subalternate, the lateral nerves mostly ascending, arcuate-anastomosing without forming a distinct marginal nerve. Inflorescence cymose, 1- to 7-flowered; peduncles in the axils of the lower often bract-like leaves of lateral branchlets. Flowers large or medium-sized. Receptacle produced above the ovary. Calyx closed in the bud or open and then truncate or 5-lobed, at anthesis irregularly 3- to 5-fid, sometimes at length irregularly circumscissile. Petals 5, orbiculate or obovate, white. Stamens numerous, the filaments incurved in the bud; anthers dorsifixed, dehiscing longitudinally. Ovary 2- to 7-celled, many-ovulate; placenta 2-lamellate; ovules in a single or triple row; stigma capitate or peltate. Berry mostly globose, many-seeded; seeds embedded in pulp, the testa dull, hard. Embryo incurved; radicle elongated; cotyledons very short.

Species about 60 in tropical America. A few species are cultivated throughout the tropics of the world for their edible fruits.

1a. Calyx open in the bud; leaves small, subsessile ..... 1. Ps. SALUTARE
b. Calyx closed in the bud; leaves shortly petiolate 2
2a. Plants glabrous 3
b. Plants pubescent 4
3a. Leaves 2.5–5.0 cm. long; young twigs subterete ..... 2. Ps. SARTORIANUM
b. Leaves 8–12 cm. long; young twigs narrowly 4-angled ..... 3. Ps. FRIEDRICHSTHALIANUM
4a. Leaves usually with 12 or more pairs of close parallel lateral nerves impressed above; young twigs 4-angular ..... 4. Ps. GUAJAVA
b. Leaves usually with 7–10 pairs of remote arcuate nerves not impressed above; young twigs compressed or subterete ..... 5. Ps. GUINEENSE

1. PSIDIUM SALUTARE (HBK.) Berg, in Linnaea 27:356. 1856.

Myrtus salutaris HBK. Nov. Gen. & Sp. 6:105. 1823.
Psidium ciliatum Benth. in Hook. Journ. Bot. 2:318. 1840.
Psidium oerstedeanum Berg, in Linnaea 27:360. 1856.
Calycolpus parviflorus Sagot, in Ann. Sci. Nat. ser. 6. 20:181. 1885.
Psidium gentlei Lundell, in Amer. Midl. Nat. 29:483. 1943.

Undershrub often less than 1 m. high, simple and sparingly branched or with several stems; twigs compressed, puberulous or glabrous. Leaves subsessile, ovate

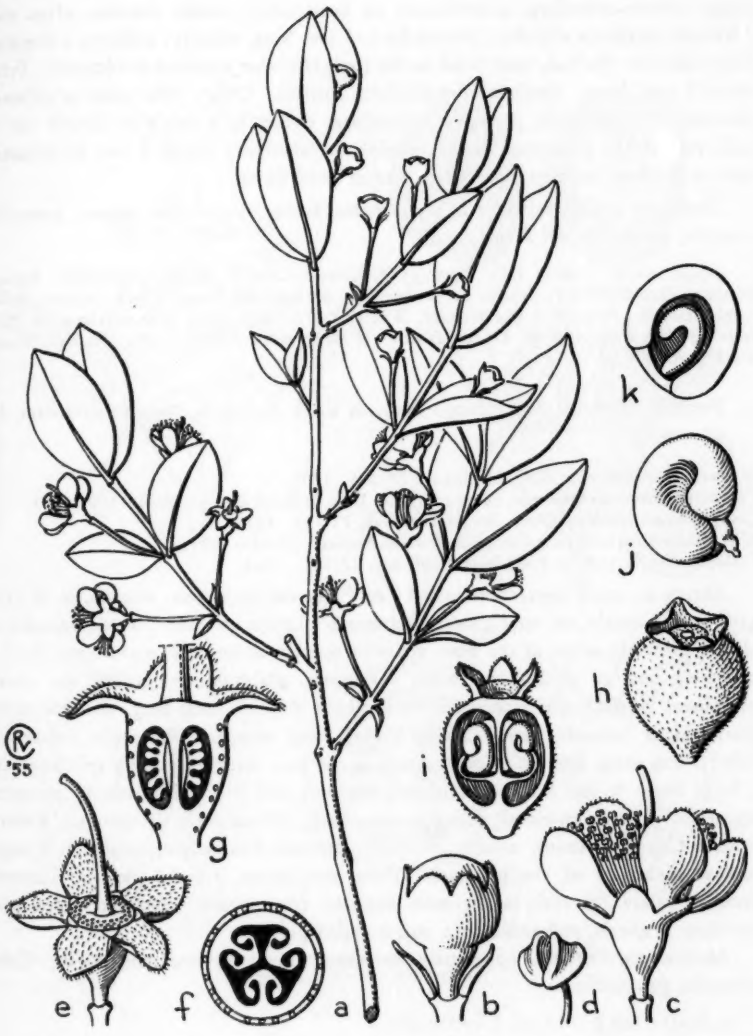

Fig. 60. *Psidium salutare*

to elliptical-oblong, rounded or obtuse at the base, acute at the apex, up to 6 cm. long and 2 cm. wide, coriaceous, at first more or less puberulous, later glabrate, the midrib elevated on both sides or nearly flat above, the lateral nerves in about 6 pairs, arcuate-ascending, prominulous on both sides; petiole obsolete, often with 2 minute setaceous stipules. Peduncles 1–3 cm. long, solitary, axillary, 1-flowered. Calyx open in the bud, later 5-fid to the base, the lobes rounded or obtusish. Petals about 7 mm. long. Anthers suborbiculate, cordate. Ovary puberulous or glabrous, obconoid, 2 mm. high; placenta 2-lamellate; ovules in a single or double row at each side of the placenta. Berry subglobose, when dry about 1 cm. in diameter, said to be about as large as a cherry and of good flavor.

Honduras and El Salvador to the Amazon basin. Vernacular names: *guayabito arrayán*; *guayabito del Perú*.

CANAL ZONE: Ancón Hill, *Piper 5535*, *Standley 25208*, *26340*. CHIRIQUÍ: Boquete District, *Davidson 835*; Sabana de la Tortuga, between El Boquete and Caldera, *Pittier 3300*. COCLÉ: Penonomé and vicinity, *Williams 211*. PANAMÁ: hills northeast of Hacienda La Gorga, 50–300 m., *Dodge, Hunter & Steyermark 16899*, *Dodge, Hunter, Steyermark & Allen 8751*.

2. PSIDIUM SARTORIANUM (Berg) Ndz. in Engl. & Prantl, Nat. Pflanzenfam. 3[7]: 69. 1893.

Mitranthes sartorianum Berg, in Linnaea 29:248. 1858.
Calyptropsidium sartorianum (Berg) Krug & Urb. in Engl. Bot. Jahrb. 19:581. 1895.
Calyptranthes tonduzii Donn. Sm. in Bot. Gaz. 23:245. 1897.
Mitropsidium sartorianum (Berg) Burret, in Notizbl. 15:487. 1941.
Psidium solisii Standl. in Field Mus. Publ. Bot. 23:133. 1944.

Shrubs or small trees, sometimes 15 m. high, the bark gray, smooth, in all parts glabrous or nearly so; young twigs subterete. Leaves petiolate, ovate, rounded or obtuse to nearly acute at the base, acute or acutely acuminate at the apex, 2.5–5.0 cm. long and up to 2.5 cm. wide, coriaceous, glabrous, the midrib flat above, prominent beneath, the lateral nerves in about 6 pairs, ascending, obsolete above, prominulous beneath; petiole about 3 mm. long, slender. Peduncles 1-flowered, 1.0–1.5 cm. long, slender. Calyx closed in the bud, later irregularly splitting with 1 large more or less lid-like deciduous segment and 2–3 other minute persistent segments.[1] Petals rounded, about 4 mm. long, ciliate, early-deciduous. Anthers ovate. Ovary glabrous, usually 3-celled; placenta 2-lamellate; ovules in a single row at each side of the placenta. Fruit subglobose, 1.5–2.0 cm. in diameter, greenish yellow, several-seeded; seeds angular, concolorous. Embryo coiled with less than 2 spirals, embedded in a coarse-celled pulp.

Mexico to Panama, apparently becoming rarer toward the south; Cuba. *Arrayán, guayabillo.*

PANAMÁ: San José Island, *Johnston 486*.

[1] The accompanying drawing, with neatly circumscissile calyx, is somewhat misleading; such abscission is exceptional.

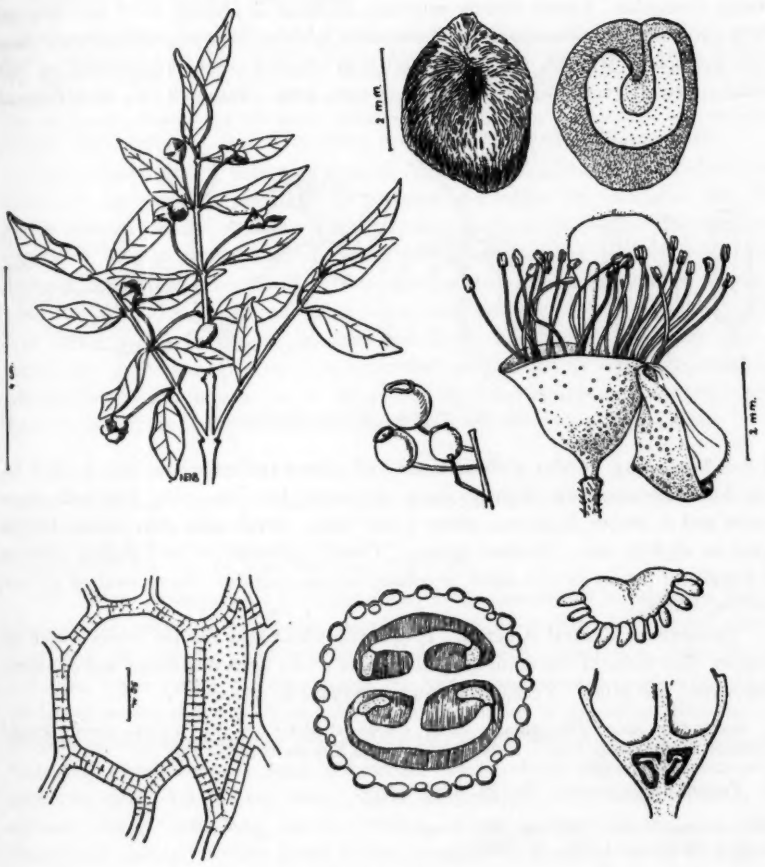

Fig. 61. *Psidium sartorianum*

3. PSIDIUM FRIEDRICHSTHALIANUM (Berg) Ndz. in Engl. & Prantl, Nat. Pflanzenfam. 3[7]:69. 1893.

Calyptropsidium friedrichsthalianum Berg, in Linnaea 27:350. 1856.

Glabrous shrubs and small trees to 9 m. high, with spreading crown and crooked bole, the bark smooth and fluted, brown, the wood fine-grained and hard; young twigs 4-angular. Leaves shortly petiolate, elliptical or oblong, 8–12 cm. long and 4–5 cm. wide, membranaceous to chartaceous, glabrous, the midrib impressed above and prominent beneath, the lateral nerves in about 8 pairs, prominulous on both sides, especially beneath; petiole about 3 mm. long. Peduncles 1- to 3-flowered,

Fig. 62. *Psidium friedrichsthalianum*

1.0–2.5 cm. long. Calyx globose in the bud, closed and apiculate, later 2- to 3-fid, the lobes circumscissile slightly above the ovary but remaining attached at one point and at length deciduous, about 1 cm. long. Petals orbiculate, about 1.5 cm. long or slightly less. Anthers oblong. Ovary glabrous, 3- to 5-celled; placenta 2-lamellate; ovules in 2–3 rows, involute; stigma peltate. Berry oval or globose, yellow, edible.

Throughout Central America. Frequently cultivated for the fruits which are smaller than those of the common guava, have a tart agreeable flavor and are sometimes used for jellies. Vernacular name: *guayaba de agua.*

BOCAS DEL TORO: Changuinola valley, *Cooper & Slater 97, 97a.* CANAL ZONE: around Gamboa, *Pittier 4809, 6521.* CHIRIQUÍ: Progreso, *Cooper & Slater 278.*

4. PSIDIUM GUAJAVA L. Sp. Pl. 470. 1753.

Psidium pomiferum L. loc. cit. 672. 1762.
Psidium pyriferum L. loc. cit. 1762.

Shrubs or small trees with peculiar pale brown bark that scales off in thin sheets; young twigs 4-angular, pubescent. Leaves elliptical to oblong, rounded, obtuse or apiculate at the apex, rounded or obtuse at the base, 4–12 cm. long and 3.5–4.5 cm. broad, chartaceous, glabrescent on both sides, the midrib impressed above and prominent beneath, the lateral nerves 12–16 on each side, impressed above and prominent beneath, parallel and arcuate-anastomosing near the margin; petiole 3–4 mm. long. Peduncles axillary, 1- to 3-flowered, pubescent. Flower buds pubescent,

constricted under the calyx, 1.0–1.5 cm. long. Calyx closed in the bud, ellipsoid, irregularly 4- to 5-fid at anthesis, its segments about 1 cm. long, sericeous inside. Petals 1.5–2.0 cm. long. Anthers linear-oblong. Ovary 3- to 5-celled; placenta 2-lamellate; ovules in a triple row at each side of the placenta, turned in all directions. Berry pear-shaped or globose, 3–6 cm. in diameter, glabrate.

Cultivated throughout the tropics.

BOCAS DEL TORO: Isla Colón, *Von Wedel 2948*; Water Valley, *Von Wedel 821*. CANAL ZONE: Chagres, *Fendler 306*; in government forest along Las Cruces Trail, *Hunter & Allen 710*; Barro Colorado Island, *Wilson 17, Woodworth & Vestal 393, Wetmore & Abbe 149*; Ancón, *Pittier 2725*. CHIRIQUÍ: Llanos del Volcán, *Allen 1536*. COCLÉ: hills south of El Valle de Antón, *Allen 2524* (in part: mixed with *Ps. guineense*); Penonomé and vicinity, *Williams 237*. PANAMÁ: Juan Díaz region, near Tapía R., *Maxon & Harvey 6738*.

The common guava, native in tropical America and cultivated throughout the tropics of the world, is abundant in pastures and rather dry thickets. On the Pacific slope of Central America it often forms extensive thickets of characteristic appearance known as *guayabales*. The wood is brownish or reddish gray, hard, strong, elastic, close-grained and durable, but the trees are too small to be of much use. The Spanish name for the fruit is *guayaba*, and for the tree *guayabo*. The fruit varies greatly in size, shape, color and flavor, and has a musky odor that is remarkably penetrating. Raw it is somewhat insipid, but it makes an excellent jelly and is prepared in other ways. In general the fruit is little esteemed in Central America, but slices of the stiff, dark colored jelly are a frequent dessert dish.

5. PSIDIUM GUINEENSE Sw. Prodr. 77. 1788.

Psidium polycarpon Anders. ex Lamb. in Trans. Linn. Soc. 11:231. *t. 17*. 1815.
Psidium araca Raddi, Mem. 5. *t. 1*. 1821.
Psidium molle Bertol. Fl. Guat. 422. *t. 9*. 1840.
Guajava mollis (Bertol.) O. Ktze. Rev. Gen. 239. 1891.

Shrubs usually less than 1 m. high; young twigs compressed to subterete, pubescent. Leaves elliptical to oblong, rounded, obtuse or acutish at the apex, obtuse or acute at the base, up to 13 cm. long and 7 cm. broad, chartaceous, pubescent on both sides when young, glabrate except the midrib and veins beneath when adult, the lateral nerves about 7–10 on each side, prominulous to flat above, prominulous beneath, arcuate-anastomosing near the margin; petiole 4–10 mm. long. Peduncles 1- to 3-flowered, 2–3 cm. long, pubescent. Flower buds pubescent, constricted under the calyx, 1.0–1.5 cm. long. Calyx irregularly 4- to 5-fid at anthesis, the segments about 7 mm. long, sericeous within. Petals 5, about 1.5 cm. long. Anthers linear-oblong. Ovary about 5 mm. long, 3- to 5-celled; ovules in a triple row at each side of the 2-lamellate placenta, turned in all directions. Berry subglobose, about 2 cm. in diameter, yellow.

Native of tropical America and cultivated in other tropical countries. Vernacular names: *guayabita, guayaba arrayán*; *guayaba de sabana*.

CHIRIQUÍ: pastures around El Boquete, *Pittier 2946*; Llanos del Volcán and near Río Chiriquí Viejo, *Allen 1007, 1536*; vicinity of Callejón Seco, Volcán de Chiriquí, *Woodson & Schery 477, 505*. COCLÉ: between Las Margaritas and El Valle, *Allen & Seibert 1295*. PANAMÁ: San José Island, *Johnston 16, Erlanson 290*; La Campana, *Zetek 4228*.